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AMPEX

1809967

VOL. 1

Domestic and International

Side Monitor Version

VR-1200B Videotape Television Recorder

Operation and Maintenance Manual

AMPEX

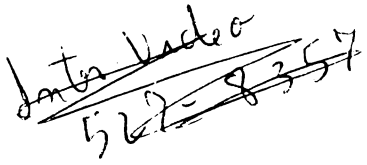
ERRATA

Date August 5, 1971

PUBLICATION VR-1200B Videotape Television Recorder (Side Monitor Version) No. 1809967-02

REASON FOR ERRATA To correct errors on "A" page and to correct pagination in Volume III.

Page Reference	Nature of Errata
VOLUME I:	Incorrect page callouts on "A" page under Volume III heading.
Title/"A" page	Remove and discard Title page from Volume I, and replace with new Title page supplied with this package.
VOLUME III:	
10-135A/136A	Remove and discard page 10-135A/136A.
10-193/194	Remove and discard pages 10-193 through 10-208, and replace with new page 10-193/194 supplied with this package.
10-417/418	Remove and discard pages 10-417 through 10-430, and replace with new page 10-417/418 supplied with this package.
	DISCARD THIS ERRATA SHEET AFTER THE ABOVE INSTRUCTIONS ARE COMPLETED.



CHANGE NOTICE

This change is to be collated into manual no.1809967-01 dated, APRIL 1969
Superseded pages are to be destroyed.

AMPEX

1809967-02

VOL I

Domestic and International

Side Monitor Version

VR-1200B Videotape Television Recorder

Operation and Maintenance Manual

ISSUED: 1 APRIL 1969

CHANGED: APRIL 1971

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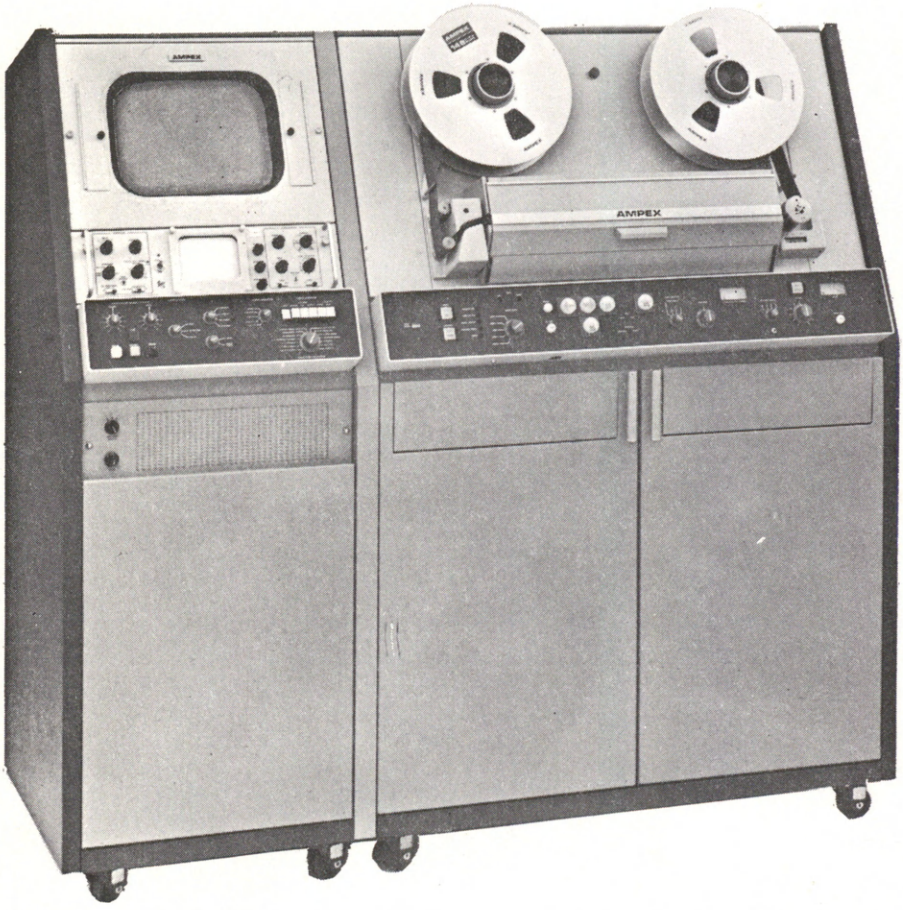
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NOTICE

Only proper use will produce the high performance and reliability for which your Ampex equipment was designed, built, and tested. In order to be sure that you obtain the best possible performance and reliability, please DO NOT:

- INSTALL or CONNECT,
- OPERATE,
- ADJUST or ALIGN,
- MAINTAIN, or
- REPAIR

the equipment without first consulting the applicable portion(s) of the manual.



V07186

VR-1200B Videotape Recorder with Side Monitor

COMMUNICATING WITH AMPEX

SERVICE INFORMATION AND PARTS

FIELD ENGINEERING BULLETIN SERVICE (See note below)

Ampex provides a continuous technical support program for its products. This program is partially implemented through field engineering bulletins, which are published by the Ampex Technical Support Group. Approved modifications, information on special tools and accessories, and improved operating and maintenance techniques are typical of the information distributed in these bulletins.

If the installation of your system or accessory was supervised by an Ampex Field engineer, you will be sent these bulletins automatically. If this is not the case, contact the nearest Ampex field office or write to:

Ampex Corporation
Video Technical Support Group
401 Broadway
Redwood City, California 94063 USA

SERVICE AND REPLACEMENT PARTS (See note below)

For service and replacement parts, contact your nearest Ampex field office. If the installation of your system or accessory was supervised by an Ampex field engineer, you will be sent information regarding the location of the nearest field office. Alternatively, write to the Technical Support Group at the address shown above.

NOTE

In order for the technical support program to function properly, the user must ensure that his communication is addressed to the proper department, and that it includes the following information, most of which can be obtained from the system identification nameplate on the equipment.

1. System name
2. Model number (including revision number)
3. System number
4. Serial number
5. Power requirements
6. System modifications and special accessories
7. Date of purchase
8. Name and address of your organization
9. Job function to which communication should be addressed
10. Physical location of equipment

COMMUNICATING WITH AMPEX

INSTRUCTION MANUAL CHANGES

Another part of the Ampex program of technical support for its products is the continuous revision and modification of instruction manuals as the equipment is improved or modified. In order to ensure that you always receive this information, write to:

Ampex Corporation
Audio/Video Technical Publications Department
401 Broadway
Redwood City, California 94063 USA

NOTE

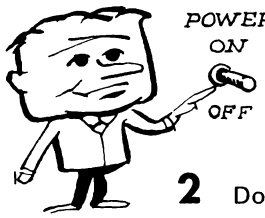
In order to be sure that you always receive information applicable to your equipment, please include the following information when you write to us:

1. System name
2. Model number (including revision number)
3. Serial number
4. Power requirements
5. System modifications and special accessories
6. Approximate date of purchase
7. Name and address of your organization
8. Job function to which communication should be addressed

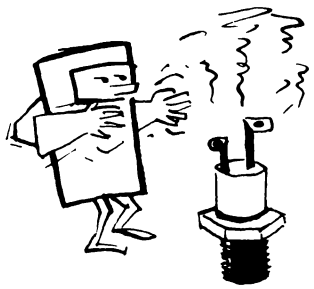
SAFETY & FIRST AID

Because personnel working with electronic equipment are exposed to the hazard of high voltage, it is imperative that all safety regulations be consistently observed, and that each individual has a clear understanding of basic First Aid methods.

The following typical hazards must be avoided at all times:



1 Do not attempt adjustment of unprotected circuit controls, or lead dress while the power is ON.

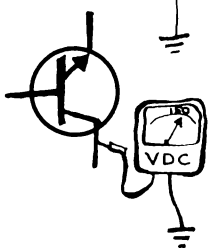


2 Do not change heavily loaded or overheated components without due precaution to avoid burns.



3 Do not assume that no dangerous voltage is present when the power is OFF. Charged capacitors may retain dangerous voltages for long periods, and should be discharged through a suitable resistor before any circuit points are touched.

4 At all times avoid placing any parts of the body in series between ground and circuit points, whether or not power is ON.



5 Do not assume that solid-state circuits and semiconductor cases carry only low voltages.



V08633

For their own protection, and the protection of others, all electronic personnel should become thoroughly familiar with the approved First Aid treatment of burns and shock. There are three principal degrees of burns, recognizable as follows:

1. A first degree burn reddens the skin
2. A second degree burn blisters the skin
3. A third degree burn chars the flesh and frequently places the victim in a state of shock accompanied by respiratory paralysis.

Respiratory paralysis in the victim can cause death within seconds, by suffocation. For this reason it is imperative that the approved method of artificial respiration be initiated immediately and continued until the victim's breathing is normal.

A muscular spasm or unconsciousness may render the victim unable to free himself of the electric power. If this is the case, turn the power OFF immediately.

CAUTION

DO NOT TOUCH HIM, OR YOU MAY SHARE HIS PREDICAMENT.

If the power cannot be turned OFF immediately, **very** carefully loop a dry rope, article of clothing, length of strong cloth, or a rolled-up newspaper around the victim and pull him free of the power. Carefully avoid touching him or his clothing.

The moment he is clear of the power, place him in a reclining position, cover him with a blanket (or newspapers) to keep him warm, and begin artificial respiration. At the first opportunity, enlist help in the summoning of a doctor. If a doctor cannot be summoned, transport the victim to the doctor, infirmary, or hospital. Be sure that the victim is kept well covered and warm while awaiting professional aid and treatment.

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INTRODUCTION TO THE MANUAL

This manual provides information required for operation and field-level maintenance of the Ampex VR-1200 Videotape Television Recorder. Information pertaining to special equipment, applications or factory-level maintenance is not included.

The manual is divided into three volumes; the first volume contains general information, installation, operation, theory of operation, and maintenance. The second volume contains schematic and wiring diagrams. The third volume contains the lists of materials and assembly drawings. The table of contents provides a detailed outline of each section.

In addition to the information described above, Volume I includes an appendix containing maintenance check-lists and data logs.

LIST OF APPLICABLE PUBLICATIONS

The following Ampex manuals are applicable to the equipment used in the VR-1200B recorder. Accessory manuals are needed only if the recorder is equipped with the accessory to which the manuals apply.

APPLICABLE MANUALS FOR STANDARD EQUIPMENT

MANUAL TITLE	MANUAL NUMBER
PROCESSING AMPLIFIER Operation and Maintenance Manual	1809989
INTERSYNC Model 1021 Solid State Television Signal Synchronizer Operation and Maintenance Manual	1809927
Mark Ten High-Efficiency Video Head Assembly Instructions for Installation and Use	1809956
Guide Servo Kit Instruction Manual	1809974

APPLICABLE MANUALS FOR ACCESSORIES

VR-1200 Video Signal System AFC Kit Operation and Maintenance Manual	1809965
Differential Gain Channel Amplifier Kit Instruction Manual	1809001
Auto-Chroma VR-1200 Videotape Recorder Accessory Operation and Maintenance Manual	1809973
One-Line Delay Accessory Instruction Manual	1809004
AMTEC Time Element Compensator Operation and Maintenance Manual	1809923

LIST OF APPLICABLE PUBLICATIONS (Continued)

MANUAL TITLE	MANUAL NUMBER
COLORTEC Model 10011 Direct Color Process Operation and Maintenance Manual	P59560
Model 1012 Universal Colortec Direct Color Recovery System Operation and Maintenance Manual	1809984
Model 1090 Automatic Velocity Compensator (VR-1200 Series) Operation and Maintenance Manual	1809990
Model 1058 Mark III Electronic Editor Operation and Maintenance Manual	1809940
MARK II EDITEC Instruction Manual	1809983
Video Head Optimizer Kit Instruction Kit	1809000
Electronic Tape Timer Kit Instruction Manual	1809002
Dial Indicator Stand Instruction Manual	1809007

SECTION I

DESCRIPTION AND LEADING PARTICULARS

SECTION I
DESCRIPTION AND LEADING PARTICULARS

1-1 SCOPE

1-2 This section describes the VR-1200B Videotape Recorder in terms of its application. A description of all accessories available is also included. Specifications of the VR-1200B are described in this section.

1-3 GENERAL DESCRIPTION

1-4 The Ampex VR-1200B (1805260) is the latest version of the VR-1200 Videotape Recorder, a self-contained television recorder/reproducer system. The VR-1200B is compatible with all other transverse-scan, four-head studio recorders which make magnetic tape recordings in conformance with SMPTE recommended practices or CCIR standards.

1-5 The VR-1200B is capable of operation on two line standards; a video standards selector switch on the signal system panel allows operation on 525- or 625-line standards in monochrome, low-band color, or high-band color formats (broadcast-quality color playback is achieved by the use of Amtec* and Colortec* accessories).

NOTE

An international version of the VR-1200B includes a 50 hertz air compressor, a power panel which allows operation from a 210- to 250-volt, 50 or 60 hertz power line, and a 5.44 megahertz standard low-pass filter in the signal system. In addition, the international version includes a modified tape timer and somewhat modified international cabling. Changes which are necessary in signal system operation (modulator deviation, playback response, etc.) between 50- and 60-field standards are automatically taken care of with the setting of the video standards selector.

1-6 Tape speed selection allows recording or reproduction at nominal tape speeds of 7.5 inches-per-second (ips) or 15 ips. Tapes recorded at 7.5 or 15 ips are fully compatible with other recorders similar in format and tape speed to the VR-1200B recorder.

NOTE

Operation of the VR-1200B recorder at 7.5 ips requires the use of a 5 mil Mark Ten Head Assembly (0.005 inch or 5 mil video track width). For operation at 15 ips, the 5 mil head or a 10 mil Mark Ten Head Assembly (0.010 inch or 10 mil video track width) may be used. However, tapes should be played back by the same type of video head assembly used to record them.

1-7 The VR-1200B videotape recorder includes a Model 1021 Intersync* servo system and a Model 1085 Processing Amplifier. These units ensure that the composite video signal from the tape system is sufficiently stable and of the proper format for broadcast use. In addition, the recorder includes an automatic guide servo and a signal system dropout sensor and demodulator input gate module.

1-8 The Intersync servo system is a solid-state unit that provides a high order of stability in the reproduced video signal, and permits the tape system time-bases to be accurately locked to the broadcast station sync generator.

*T.M., Ampex Corporation

1-9 The processing amplifier operates on 525- or 625-line monochrome or color standards and provides noise-free sync for the composite video output of the tape system; levels of peak-to-peak video, sync, pedestal, and color burst are adjustable by the user.

1-10 The guide servo provides automatic head-tip penetration control, and eliminates skewing errors during playback. This is a particularly useful function when tapes recorded with non-standard penetration are reproduced.

1-11 The dropout sensor and demodulator input gate (signal system module 13) operates in both the record and playback modes of the VR-1200B. During recording, it is used with the afc accessory (signal system module 4) to provide a white-level calibration pulse for carrier deviation alignment. During playback, it senses tape dropouts and works with the one-line delay accessory (signal system module 16) to replace an affected line of video with a repeat of the preceding line or with a line of blanking-level signal.

1-12 PHYSICAL DESCRIPTION

1-13 The VR-1200B recorder is completely housed in a single console with the exception of the air bearing system compressor. Figure 1-1 shows the location of major components of the recorder.

1-14 The tape transport is mounted on a sloping surface of the console cabinet. The recorder is equipped with a Mark Ten Head Assembly that uses air bearings. Rotary transformers couple the signals to and from the heads and eliminate the need for slip rings and brushes. Transistor preamplifiers are mounted on the head assembly. A head cover, mounted over the head assembly on the transport, protects the video head assembly and attenuates audible noise.

1-15 The main control panel is located below the transport and provides the operator with all the necessary primary operating controls and indicators. The VR-1200B may be operated from a remote location by the use of an optional remote control unit, which is connected to the system through a remote control connector located on the external connector panel at the lower rear of the console.

1-16 The electronics chassis are located behind the hinged doors of the cabinet. The monitor console can be furnished as either the left-hand or right-hand bay of the VR-1200B. Recorders with left- and right-hand monitor bays are functionally identical. For the recorder illustrated in Figure 1-1, the left-hand bay of the cabinet houses the video monitor, waveform monitor, monitor switching panel, audio monitor, velocity compensator accessory, and a cooling fan assembly. The center bay houses the video signal system chassis, the Intersync servo chassis, the electronic editor chassis, and a cooling fan assembly. Primary controls of the electronic editor are located on the left side of the tape transport, and secondary controls and indicators of each chassis are located on the individual chassis. The right-hand bay houses the audio and cue chassis, the Colortec* accessory (or the Universal Colortec* accessory), the Amtec accessory, the video processing amplifier, the system power supplies, the power control panel, and a cooling fan assembly.

1-17 ACCESSORIES

1-18 Operating Accessories

1-19 The following accessories are used in the operation of the VR-1200B recorder:

a. Transport Remote Control Unit. This accessory provides remote control of the tape transport, enabling all functions to be initiated from a remote location.

b. Processing Amplifier Remote Control. This accessory allows the format of the output video signal to be set at a location remote from the recorder.

c. Video Head Optimizer Kit. This accessory facilitates the routine maintenance procedure of setting the optimum record current and playback equalization for each video head, reducing it from a 15-minute or longer procedure to two minutes or less, and producing improved results.

d. Electronic Tape Timer Kit. This accessory replaces the mechanical tape timer used in the VR-1200B, and provides an instant indication of elapsed time or remaining time on any tape. In addition, the unit may be programmed to activate (or de-

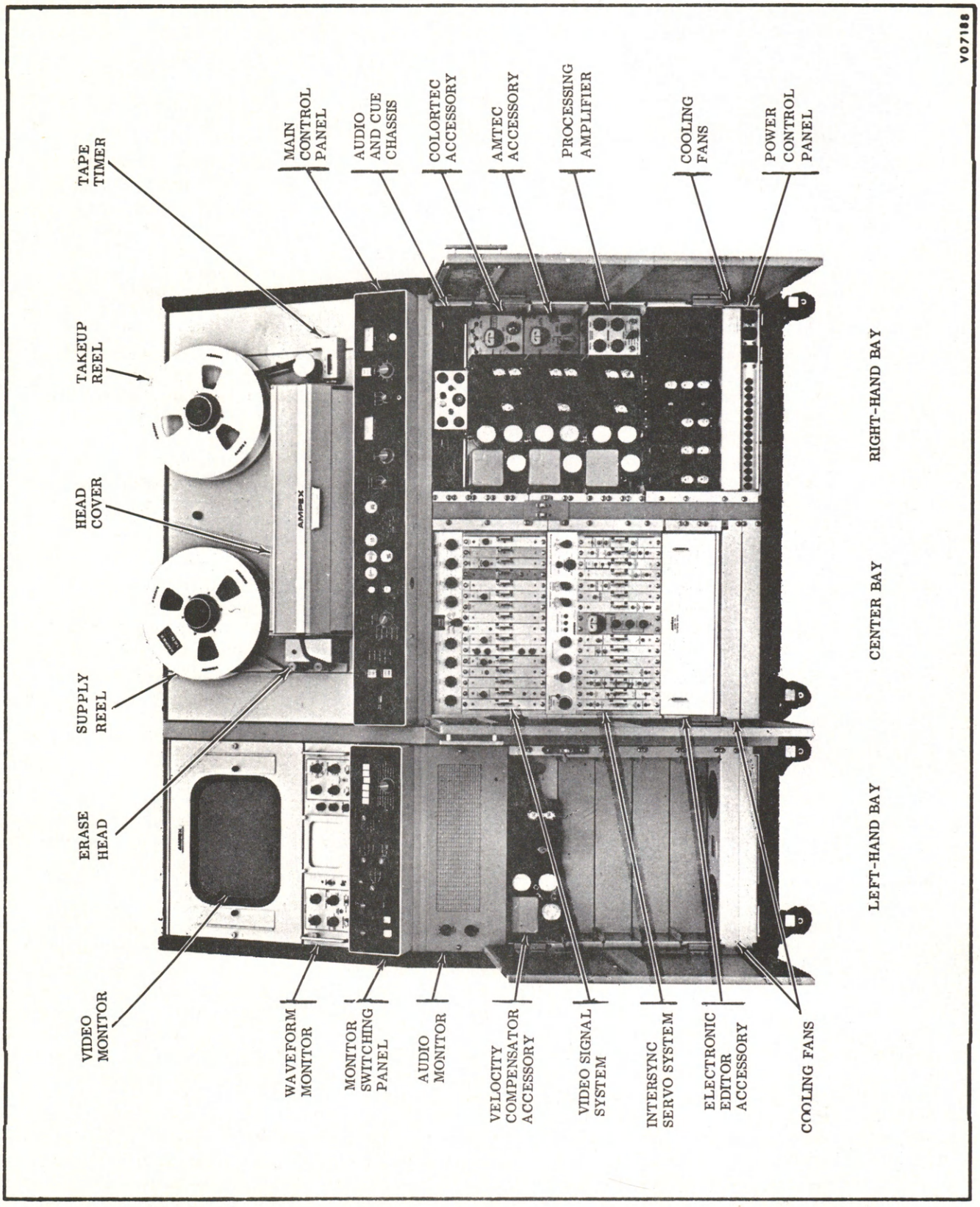


Figure 1-1. VR-1200B Videotape Recorder, Front View

activate) another unit when a preset time is reached in the tape.

1-20 Signal System Accessories

1-21 The following accessories are used in the VR-1200B signal system:

a. Input Low Pass Filter (Module 1). This accessory removes stray rf and other high-frequency components from the input signal. This capability is normally needed only if there are large amounts of high-frequency noise on the signal such as some vidicon cameras generate, or if the recorder is operated near the transmitter.

b. AFC Kit (Modules 3 and 4). The automatic frequency control accessory provides highly accurate automatic control of the modulator carrier frequency, and eliminates the need for routine calibration of the modulator. In addition, the afc reference functions with the signal system dropout sensor and demodulator input gate (module 13) to provide a white-level calibration pulse for setting modulator deviation.

c. Auto-Chroma* Kit (Modules 14 and 15). This accessory provides highly accurate automatic playback equalization control of the four head channels and maintains the proper burst to chroma ratio. The need for other than routine attention to playback equalization controls is eliminated.

NOTE

This accessory is used in color-equipped systems only.

d. Low-Pass Filters (Module 10). 4.2, 4.5, 5.0, and 6.0 megahertz low-pass filters are available as accessories to replace the 4.4 or 5.44 megahertz single-ended filter normally supplied with a VR-1200B recorder. These Bode-type accessory filters offer improved transient response.

e. One-Line Delay Accessory (Module 16). This accessory functions with the dropout sensor and demodulator input gate (module 13) to substitute the preceding line of video or a line of blanking-level signal for a line of video affected by dropouts.

1-22 Color Accessories

1-23 The following accessories are used in the operation of the VR-1200B for color television:

a. Model 1061 Amtec Time Element Compensator. The Amtec accessory eliminates picture distortion caused by geometric errors in the head assembly and residual time-base errors left by the servo system.

b. Model 1011 Colortec Direct Color Processor. The Colortec accessory provides faithful reproduction of standard NTSC color television recordings, and of non-standard color recordings that meet sync rate-of-change specifications set by the FCC.

c. Model 1012 Universal Colortec Direct Color Recovery System. The Universal Colortec accessory is used in place of the Model 1011 Colortec accessory, and functions on both 525- and 625-line standards to provide faithful reproduction of NTSC, PAL, and SECAM signals.

d. Model 1090 Automatic Velocity Compensator. The velocity compensator, in conjunction with the Amtec and Colortec (or Universal Colortec) accessories, compensates for time-base errors caused by variations between record mode and playback mode head-to-tape velocities.

1-24 Editing Accessories

1-25 The following accessories are used for editing video tape on the VR-1200B recorder:

a. Model 1058 Mark III Electronic Editor. This accessory provides accurate electronic splicing of program material without loss of sync or picture stability, and eliminates the need for cutting and mechanically splicing tape.

b. Model 1065 Mark II Editec. This accessory is a programming unit for the electronic editor.

1-26 Maintenance Accessories

1-27 The following accessories are used during maintenance of the VR-1200B recorder.

a. Video Head Tip Inspection Microscope. The illuminated head tip inspection microscope 1214417 is used to determine if head tips are suffering from premature wear or damage.

b. Air Compressor Test Kit. The compressor test kit 800-787 is used for checking the volumetric output of the system bearing air compressor, and determining when overhaul of the compressor is required.

1-28 SPECIFICATIONS

1-29 Table 1-1 gives general specifications of the VR-1200B recorder. Tables 1-2 through 1-8 give specifications pertaining to various record and playback standards. The general specifications assume that an Ampex Amtec time element compensator and Ampex Type 148 magnetic tape or equivalent are used. Because of possible design improvements or equipment modifications, all specifications listed in this section are subject to change without notification.

1-30 Tables 1-2 through 1-6 list video performance specifications in terms of "levels"; the performance levels are defined as follows:

a. Level 1: The VR-1200B is equipped with an Intersync servo system and an Amtec accessory.

b. Level 2: The VR-1200B is equipped with an Intersync servo system, an Amtec accessory, and a Colortec (or Universal Colortec) accessory).

c. Level 3: The VR-1200B is equipped with an Intersync servo system, an Amtec accessory, a Colortec (or Universal Colortec) accessory, and a Differential Gain Channel Amplifier Kit.

Table 1-1. General Specifications

CHARACTERISTIC	SPECIFICATION
Power Requirements	
VR-1200B	117V 60 Hz 30A max (see note)
VR-1200B (international version)	230V 50 Hz 15A max (see note)
NOTE The maximum current does not include additional loads that may be connected to the convenience outlets, as these outlets are supplied from a separate power line.	
Physical Characteristic	
Dimensions	
Height	62.5 in.
Width	63.5 in.
Depth	30 in.
Weight	1000 lb max

Table 1-1. General Specifications (Continued)

CHARACTERISTIC	SPECIFICATION
Video Input Signals	
Composite video	
Impedance	75 ohm (±1%) resistive, unbalanced
Amplitude	0.7 to 1.8V p-p
Sync polarity	Neg
EIA Standard	RS170 Rev TR135
FCC Standard	Sec. 3.682, sub sec. (a), transmission standards and sec. 3.699 Figures 5, 6, and 7
Sync input	2 to 8V p-p (see Note)
Horizontal drive input	4V p-p, nom (see Note)
Subcarrier input	2V p-p, nom (see Note)
7.8 kHz reference (625-line standards only)	0.5 to 4.0V p-p (see Note)
NOTE Sync, horizontal drive, subcarrier, and 7.8 kHz reference signals must be from a common source	
Video Output Signals	
Composite Video	
Impedance	75 ohms (±1%) resistive, unbalanced
Amplitude	Nominal level switchable to 1.0 or 1.4V p-p
Sync Polarity	Neg
EIA Standard	RS 170 Rev TR135
FCC Standard	Sec. 3.682, sub sec. (a), transmission standards and sec. 3.699 Figures 5, 6, and 7
Non-Composite Video	
Impedance	75 ohms (±1%) resistive, unbalanced
Amplitude	Nominal level switchable to 0.7 or 1.0V p-p
Sync Output	
Impedance	75 ohm (±5%) resistive, unbalanced
Amplitude	4.0V p-p

Table 1-1. General Specifications (Continued)

CHARACTERISTIC	SPECIFICATION
Audio and Cue Signals	
Audio Input Signal	
Impedance	15 k ohm bal bridging input for 500/600 ohm line (unbal input with wiring changes)
Amplitude	-10 dBm min
Source	Line
Audio Output Signal	
Impedance	600 ohm bal or unbal
Amplitude	+8 dBm (0 vu) nom, +16 dBm max
Cue Input Signal	
Impedance	15 k ohm bal or unbal bridging input for 500/600 ohm line
Amplitude	+8 dBm nom, -10 dBm min
Source	Line or supplied microphone
Cue Output Signal	
Impedance	600 ohm bal or unbal
Amplitude	+8 dBm nom
Recording Medium	Magnetic tape, 2-in. nom width, "Mylar" polyester base of 0.001 in. (1 mil) thickness in accordance with ASA Standard C98.1 and proposed SMPTE standard PH 22.123
Video Track Width	
7.5 ips (30 frame)	0.005 in. (5 mil)
7.813 ips (25 frame)	0.005 in. (5 mil)
15 ips (30 frame)	0.005 in. (5 mil) or 0.010 in. (10 mil)
15.625 ips (25 frame)	0.005 in. (5 mil) or 0.010 in. (10 mil)
Picture to Sound Separation	
7.5 ips (30 frame)	Sound leads by 37 frames
15 ips (30 frame)	Sound leads by 18.5 frames
7.813 ips (25 frame)	Sound leads by 29.6 frames
15.625 ips (25 frame)	Sound leads by 14.8 frames
Recording Time (7200 ft reel)	
7.5 ips	192 minutes max
7.813 ips	184 minutes max
15 ips	96 minutes max
15.625 ips	92 minutes max

Table 1-1. General Specifications (Continued)

CHARACTERISTIC	SPECIFICATION
Environment	
Ambient temperature (tape limited)	32 degree F (0 degree C) to 113 degree F (45 degree C)
Relative humidity	10% to 90%
Starting Time	
Starting from ready mode	Preset mode: 2 sec max Normal mode: 2 sec max Vertical mode (60 fields/sec): 4 sec max Vertical mode (50 fields/sec): 5 sec max Horizontal mode: 2 sec max Auto mode (60 field/sec): 4 sec max Auto mode (50 field/sec): 5 sec max
With motors stopped and capture range extension circuits disabled*	Preset mode: 4 sec nom Normal mode: 4 sec nom Vertical mode: 5 sec max Horizontal mode: 4 sec nom Auto mode: 5 sec max
With motors stopped and capture Range extension circuits connected*	Preset mode: 4 sec nom Normal mode: 4 sec nom Vertical mode: 6 sec max Horizontal mode: 4 sec Auto mode: 6 sec max
Stopping Distance	3 in. tape travel in record or playback mode
Shuttling Speed	Zero to more than 300 ips in fast forward or rewind mode. Average speed for transfer of 4800-ft reel: 175 ips
Transfer Time for 4800 ft reel	5-1/2 min
Video Erasure	Erased video is at least 50 dB down from its p-p pre-erasure level
Tape Timer Accuracy	Repeatable to ±0.1%, or ±5 sec for a 4800-ft reel of tape
Video Head Life	Guaranteed for 100 hrs on a pro-rated basis
Vertical Line Displacements	Horizontal displacements of vertical picture elements between adjacent channels do not exceed 100 nsec

*The Intersync servo system is normally shipped from the factory with the capture range extension circuits connected. Refer to Section II for instructions to disable these circuits.

Table 1-2. 525-Line Monochrome Low-Band Video Performance Specifications

CHARACTERISTIC	SPECIFICATION		
	LEVEL 1	LEVEL 2	LEVEL 3
Recording			
White level carrier frequency	6.80 MHz	6.80 MHz	6.80 MHz
Blanking level carrier frequency	5.00 MHz	5.00 MHz	5.00 MHz
Nominal sync tip carrier frequency	4.28 MHz	4.28 MHz	4.28 MHz
Standard picture to sync ratio	0.714/0.286	0.714/0.286	0.714/0.286
Type of video signal	Monochrome	Monochrome	Monochrome
Demodulator low-pass filter required	4.4 MHz	4.4 MHz	4.4 MHz
Playback			
Overall system bandwidth relative to 100 kHz (measured at mid-grey level)	Flat to 3.8 MHz; -3 db at 4.4 MHz, Tol: ±1.5 dB	Flat to 4.1 MHz; -3 dB at 4.5 MHz; Tol: ±1 dB	Flat to 4.1 MHz; -3 dB at 4.5 MHz Tol: ±1 dB
SNR (ratio of peak-to-peak non-composite video to rms noise) measured at mid-grey level using a wide-band true rms voltmeter through a 5.8 MHz low-pass filter. (Standard tip penetration.)	45 dB min	45 dB min	45 dB min
Transient response (K-factor) using 2T sine2 pulse (half-amplitude duration of 0.25 Usec)	2% max	2% max	2% max
Rise time using step input, 10 to 90% levels (signal rise time 0.02 Usec or less)	0.13 Usec max	0.13 Usec max	0.13 Usec max
Low frequency linearity, blanking to white, departure from straight line	2% max	2% max	2% max

NOTE

Figures for bandwidth, SNR, and rise time shown in this table are based upon the use of the standard 4.4 MHz filter normally supplied. Other demodulator low-pass filters which are available as accessories will affect these values.

Table 1-3. 525-Line Color Low-Band Video Performance Specifications

CHARACTERISTIC	SPECIFICATION		
	LEVEL 1	LEVEL 2	LEVEL 3
701 Recording			
White level carrier frequency	6.50 MHz	6.50 MHz	6.50 MHz
Blanking level carrier frequency	5.79 MHz	5.79 MHz	5.79 MHz
Nominal sync tip carrier frequency	5.50 MHz	5.50 MHz	5.50 MHz
Standard picture to sync ratio	0.714/0.286	0.714/0.286	0.714/0.286
Type of video signal	NTSC Color	NTSC Color	NTSC Color
Color subcarrier frequency	3.58 MHz	3.58 MHz	3.58 MHz
Demodulator low-pass filter required	4.4 MHz	4.4 MHz	4.4 MHz
Playback			
Overall system bandwidth relative to 100 kHz (measured at mid-grey level)	Flat to 3.8 MHz; -3 dB at 4.4 MHz; Tol: ±1.5 dB	Flat to 4.1 MHz; -3 dB at 4.5 MHz; Tol: ±1 dB	Flat to 4.1 MHz; -3 dB at 4.5 MHz; Tol: ±1 dB
SNR (ratio of peak-to-peak non-composite video to rms noise) measured at mid-grey level using a wide-band true rms voltmeter through a 5.8 MHz low-pass filter. (Standard tip penetration.)	40 dB min	40 dB min	40 dB min
Transient response (K-factor) using 2T sine2 pulse (half-amplitude duration of 0.25 Usec)	2% max	2% max	2% max
Rise time using step input, 10 to 90% levels (signal rise time 0.02 Usec or less)	0.13 Usec max	0.13 Usec max	0.13 Usec max
Low frequency linearity, blanking to white, departure from straight line	2% max	2% max	2% max
Color differential gain, blanking to white	5% max	5% max	5% max
Color differential phase, blanking to white at 3.58 MHz	5 degrees max	5 degrees max	5 degrees max

Table 1-3. 525-Line Color Low-Band Video Performance Specifications (Continued)

CHARACTERISTIC	SPECIFICATION		
	LEVEL 1	LEVEL 2	LEVEL 3
Color phase error due to differential phase, using color bar signal (75% saturation). Reference to burst.	3 degrees max	3 degrees max	3 degrees max
Color Moire patterning (ratio of wanted signal to greatest unwanted spurious component on least favorable color bar at 75% saturation).	-24 dB max	-24 dB max	-24 dB max

NOTE

Figures for bandwidth, SNR, and rise time shown in this table are based upon the use of the standard 4.4 MHz filter normally supplied. Other demodulator low-pass filters which are available as accessories will affect these values.

Table 1-4. 525-Line Color High-Band Video Performance Specifications

CHARACTERISTIC	SPECIFICATION		
	LEVEL 1	LEVEL 2	LEVEL 3
Recording			
White level carrier frequency	10.00 MHz	10.00 MHz	10.00 MHz
Blanking level carrier frequency	7.90 MHz	7.90 MHz	7.90 MHz
Nominal sync tip carrier frequency	7.06 MHz	7.06 MHz	7.06 MHz
Standard picture to sync ratio	0.714/0.286	0.714/0.286	0.714/0.286
Type of video signal	Monochrome or NTSC Color	Monochrome or NTSC Color	Monochrome or NTSC Color
Color subcarrier frequency	3.58 MHz	3.58 MHz	3.58 MHz
Demodulator low-pass filter required	4.4 MHz	4.4 MHz	4.4 MHz
Playback			
Overall system bandwidth relative to 100 kHz (measured at mid-grey level)	Flat to 3.8 MHz; -3 db at 4.4 MHz, Tol: ±1 dB	Flat to 4.1 MHZ; -3 dB at 4.5 MHz, Tol: ±0.5 dB	Flat to 4.1 MHz; -3 dB at 4.5 MHz Tol: ±0.5 dB

Table 1-4. 525-Line Color High-Band Video Performance Specifications (Continued)

CHARACTERISTIC	SPECIFICATION		
	LEVEL 1	LEVEL 2	LEVEL 3
SNR (ratio of peak-to-peak non-composite video to rms noise) measured at mide-grey level using a wide-band true rms voltmeter through a 5.8 MHz low-pass filter. (Standard tip penetration.)	46 dB min	46 dB min	46 dB min
Transient response (K-factor) using 2T sine2 pulse (half-amplitude duration of 0.25 Usec)	2% max	1.5% max	1.5% max
Rise time using step input, 10 to 90% levels (signal rise time 0.02 Usec or less)	0.12 Usec max	0.12 Usec max	0.12 Usec max
Low frequency linearity, blanking to white, departure from straight line	2% max	2% max	2% max
Color differential gain, blanking to white	8% max	8% max	8% max
Color differential phase blanking to white at 3.58 MHz	5 degree max	5 degree max	4 degree max
Color phase error due to differential phase, using color bar signal (75% saturation). Reference to burst.	3 degree max	3 degree max	3 degree max
Color Moire patterning (ratio of wanted signal to greatest unwanted spurious component on least favorable color bar at 75% saturation).	-37 dB max	-40 dB max	-40 dB max

NOTE

Figures for bandwidth, SNR, and rise time shown in this table are based upon the use of standard 4.4 MHz filter normally supplied. Other demodulator low-pass filters which are available as accessories will affect these values.

Table 1-5. 625-Line Low-Band Video Performance Specifications

CHARACTERISTIC	SPECIFICATION		
	LEVEL 1	LEVEL 2	LEVEL 3
Recording			
White level carrier frequency	6.80 MHz	6.80 MHz	6.80 MHz
Blanking level carrier frequency	5.54 MHz	5.54 MHz	5.54 MHz
Nominal sync tip carrier frequency	5.00 MHz	5.00 MHz	5.00 MHz
Standard picture to sync ratio	0.7/0.3	0.7/0.3	0.7/0.3
Type of video signal	Monochrome	Monochrome	Monochrome
Demodulator low-pass filter required	5.44 MHz	5.44 MHz	5.44 MHz
Playback			
Overall system bandwidth relative to 100 kHz (measured at mid-grey level)	Flat to 4.7 MHz; -3 dB at 5.4 MHz; Tol: ±1.5 dB	Flat to 5.5 MHz; -3 dB at 6.0 MHz; Tol: ±1 dB	Flat to 5.5 MHz; -3 dB at 6.0 MHz; Tol: ±1 dB
SNR (ratio of peak-to-peak non-composite video to rms noise) measured at mid-grey level using a wide-band true rms voltmeter through a 5.8 MHz low-pass filter. (Standard tip penetration.)	42 dB min	42 dB min	42 dB min
Transient response (K-factor) using 2T sine2 pulse (half-amplitude duration of 0.25 Usec)	2% max	2% max	2% max
Rise time using step input, 10 to 90% levels (signal rise time 0.02 Usec or less)	0.12 Usec max	0.12 Usec max	0.12 Usec max
Low frequency linearity, blanking to white, departure from straight line	2% max	2% max	2% max

NOTE

Figures for bandwidth, SNR, and rise time shown in this table are based upon the use of the standard 5.44 MHz filter normally supplied. Other demodulator low-pass filters which are available as accessories will affect these values.

Table 1-6. 625-Line High-Band Video Performance Specifications

CHARACTERISTIC	SPECIFICATION		
	LEVEL 1	LEVEL 2	LEVEL 3
Recording			
White level carrier frequency	9.30 MHz	9.30 MHz	9.30 MHz
Blanking level carrier frequency	7.80 MHz	7.80 MHz	7.80 MHz
Nominal sync tip carrier frequency	7.16 MHz	7.16 MHz	7.16 MHz
Standard picture to sync ratio	0.7/0.3	0.7/0.3	0.7/0.3
Type of video signal	Monochrome or Color	Monochrome or Color	Monochrome or Color
Color subcarrier frequency	4.43 MHz	4.43 MHz	4.43 MHz
Demodulator low-pass filter required	5.44 MHz	5.44 MHz	5.44 MHz
Playback			
Overall system bandwidth relative to 100 kHz (measured at mid-grey level)	Flat to 4.7 MHz; -3 dB at 5.4 MHz; Tol: ±1 dB	Flat to 5.5 MHz; -3 dB at 5.4 MHz; Tol: ±0.5 dB	Flat to 5.5 MHz; -3 dB at 6.0 MHz; Tol: ±0.5 dB
SNR (ratio of peak-to-peak non-composite video to rms noise) measured at mid-grey level using a wide-band true rms voltmeter through a 5.8 MHz low-pass filter. (Standard tip penetration.)	43 dB min	43 dB min	43 dB min
Transient response (K-factor) using 2T sine2 pulse (half-amplitude duration of 0.25 Usec)	2% max	1.5% max	1.5% max
Rise time using step input, 10 to 90% levels (signal rise time 0.02 Usec or less)	0.10 Usec max	0.10 Usec max	0.10 Usec max
Low frequency linearity, blanking to white, departure from straight line	2% max	2% max	2% max
Color differential gain, blanking to white	7% max	7% max	4% max
Color differential phase, blanking to white at 4.43 MHz	5 degrees max	5 degrees max	4 degrees max

Table 1-6. 625-Line High-Band Video Performance Specifications (Continued)

CHARACTERISTIC	SPECIFICATION		
	LEVEL 1	LEVEL 2	LEVEL 3
Color phase error due to differential phase, using color bar signal (75% saturation).	2 degrees max	2 degrees max	2 degrees max
Color Moire patterning (ratio of wanted signal to greatest unwanted spurious component on least favorable color bar at 75% saturation).	-28 dB max	-28 dB max	-28 dB max
NOTE Figures for bandwidth, SNR, and rise time shown in this table are based upon the use of the standard 5.44 MHz filter normally supplied. Other demodulator low-pass filters which are available as accessories will affect these values.			

Table 1-7. Audio Performance Specifications

CHARACTERISTIC	SPECIFICATION
Frequency Response	
15 ips	±2 dB, 50 to 12.000 Hz
7.5 ips	±2 dB, 50 to 10,000 Hz
Signal to Noise Ratio ar 400 Hz	Not less than 53 dB below Peak Operating level. Peak Operating Level is 6 dB above Normal Operating Level (0 vu on the AUDIO meter) as established by the Ampex Standard Alignment Tape.
Flutter and wow (total of all components from 0.6 to 250 Hz)	
15 Ips	0.10% rms max
7.5 ips	0.15% rms max
Distortion (measured at 1 kHz)	
At Normal Operating Level as established by the Ampex alignment tape (0 vu on the AUDIO meter)	1% total rms max
At peak operating level (6 dB above Normal Operating Level)	3% total rms max

Table 1-8. Cue Performance Specifications

CHARACTERISTIC	SPECIFICATION
Frequency Response	
15 ips	±3 dB, 60 to 8000 Hz
7.5 ips	±3 dB, 60 to 5000 Hz
	NOTE
There is a 15 dB notch in the frequency response at the control track frequency (240 or 250 Hz); notch bandwidth (3 dB points) is approximately 150 to 400 Hz.	
Signal to Noise Ratio	39 dB min below Normal Operating Level as established by the Ampex Alignment Tape
Flutter and wow (total of all components from 0.6 to 250 Hz)	
15 ips	0.10% rms max
7.5 ips	0.15% rms max
Distortion (measured at 1 kHz) when reproducing tape recorded at normal operating level (0 vu on the AUDIO meter)	5% rms max

SECTION II

INSTALLATION

SECTION II

INSTALLATION

2-1 SCOPE

2-2 This section provides unpacking and installation instructions for the VR-1200B videotape recorder.

2-3 UNPACKING

2-4 When unpacking the recorder, use care to prevent damage to cabinet finish, the video monitor, etc. Check the equipment received against the packing list to ensure that it is complete, and inspect carefully for any damage which may have occurred during shipment.

2-5 After the recorder has been placed in its permanent location, the user should remove the shipping hardware; this includes lacing cord over the system control unit cover, tape on the vacuum system filter jars, and various shipping screws used to lock track-mounted units (the processing amplifier and the Amtec, Colortec, and velocity compensator accessories) in place. (The bar across the system power supply may be left in place until service is required.) Figures 1-1 and 2-1 show the locations of these screws.

NOTE

It is not necessary to remove the recorder rear panel at this time to remove shipping screws; the rear panel will be removed to connect the compressor air line (paragraph 2-18).

2-6 LOCATION

2-7 Environment

2-8 The area chosen should be adequately lighted, well ventilated, relatively dust free, and isolated from electrostatic noise sources such as motors, generators, etc. Avoid areas where strong magnetic fields exist. Excessive dust may cause signal dropouts, and magnetic fields may degrade the recorded signals. The environmental conditions must be within the limits specified in Chapter 1, Section II.

2-9 Area

2-10 A system location which offers maximum production area visibility will afford the greatest operating convenience. The VR-1200B Videotape Recorder occupies a floor area of 64 inches by 34 inches. The cabinet is equipped with corner-mounted casters, each supporting approximately 225 lbs (dependent upon accessories). A clear floor area of 6 feet by 9 feet will permit freedom of movement and adequate access to all parts of the equipment. The compressor of the air bearing system may be located in a remote location to keep ambient noise at a minimum.

NOTE

Excess humidity in the bearing air is filtered out and collected by the bearing air filter system in the recorder. Periodically, the collected water is discharged through a small tube which terminates at the bottom of the recorder. This should be kept in mind when selecting a location.

2-11 INSTALLATION

2-12 Installation of the VR-1200B recorder includes signal and power interconnecting. Connector panels located at the rear of the console provide all necessary signal and power connections. (See Figure 2-1.)

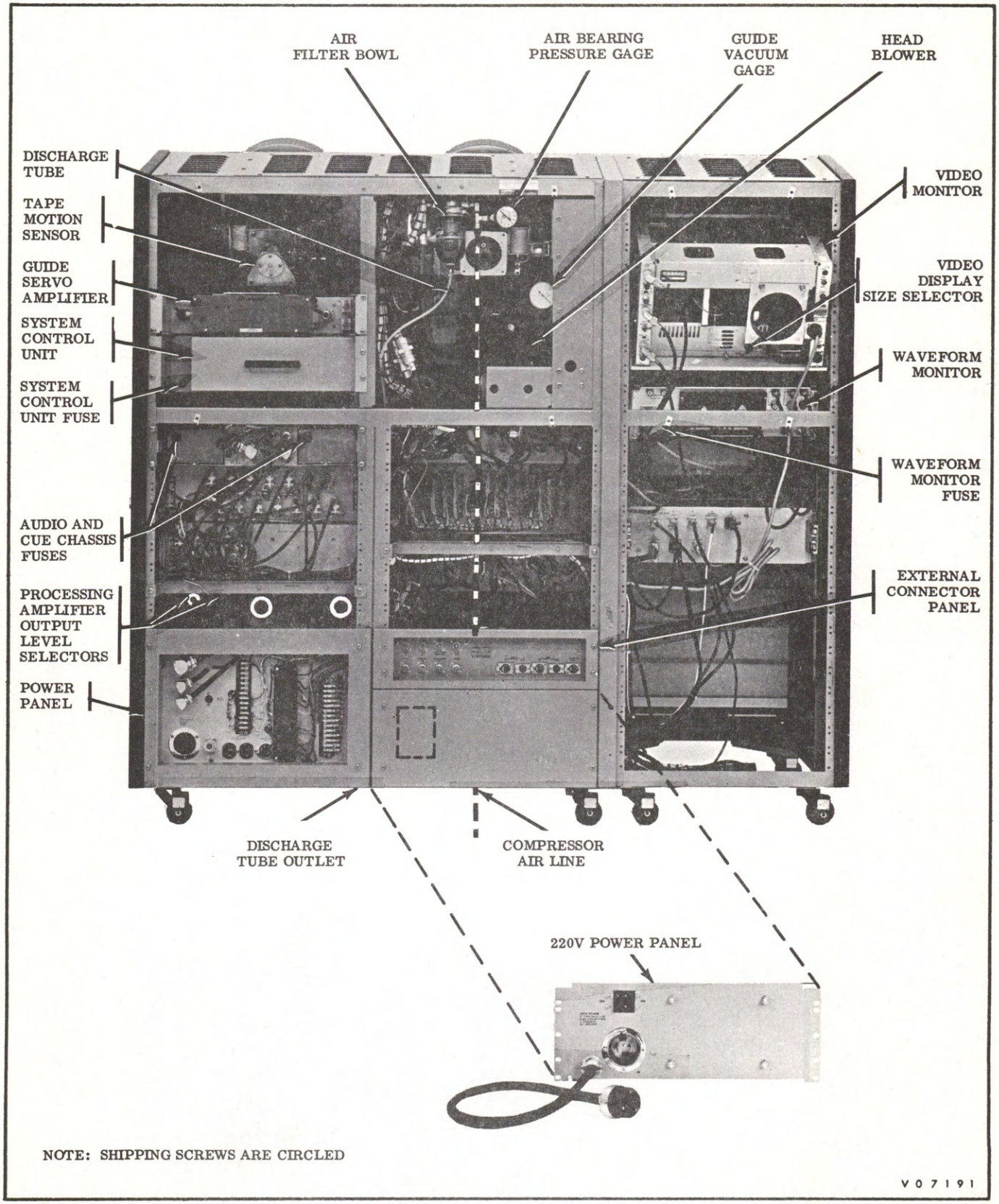


Figure 2-1. VR-1200B Videotape Recorder, Rear View

2-13 System Power Connections

2-14 The power cable furnished with the VR-1200B recorder is a 10 AWG, standard three-conductor, rubber insulated cable fitted with appropriate connectors. Power is connected to the system through the power distribution panel (see Figure 2-2). The power cable of the air bearing system compressor is also connected to this panel. The auxiliary power outlets on the power distribution panel must be supplied from a separate 15 ampere power line through connector J11; use a Harvey Hubbell 7593 (or equivalent) to mate with J11.

CAUTION

BE SURE THE AUXILIARY POWER IS SUPPLIED FROM A THREE-WIRE GROUNDED OUTLET THROUGH THREE-CONDUCTOR CABLE.

2-15 Instructions for installing the 220-volt power panel in the international version of the VR-1200B recorder are given in paragraph 2-40.

2-16 Signal Connections

2-17 The external connector panel (Figure 2-3) provides video, audio, cue, and all necessary reference signal connections. All video and reference interconnecting cables should be of minimum length, yet permit free movement of the console within the operating location. The video input and output cables should be Belden #8281 or equivalent, and all reference cables should be RG59B/U coaxial or equivalent. The audio and cue cabling should be 2-conductor, 20 or 22 Awg shielded, insulated cables fitted with the three-pin audio connectors furnished (ITT/Cannon XLR-3-12C male and XLR-3-11C female or equivalent). Connect as shown in Figure 2-4.

2-18 Air Connection

2-19 The bearing-air hose furnished with the VR-1200 recorder is approximately the same length as the power cable of the compressor; the two may be laced together after installation. Air from the compressor is connected to the system through the connector next to the air filter bowl at the rear of the machine (see Figure 2-1). Remove the rear panel of the recorder and dress the air hose through the console as shown; be sure the air connection is tight. Do not replace the rear panel at this time.

NOTE

Provision may be made at this time for collecting the water from the bearing-air filter system for later disposal; use a small pan or other suitable means.

2-20 PROCESSING AMPLIFIER SETUP

2-21 The processing amplifier provides two composite video outputs at switch-selected levels of 1.0 or 1.414 volts peak-to-peak. In addition, a non-composite video output at 0.707 or 1.0 volt peak-to-peak is available. Set the switches (locations are shown in Figure 2-1) to the positions desired.

NOTE

The high level positions of these switches may be used to compensate for the 3 dB loss of a line equalizer, if one is used. If the VR-1200B is equipped with a monitor bridge accessory, the VIDEO OUTPUT 2 selector must be left at 1.0V p-p.

2-22 If a monitor bridge accessory is to be installed, continue the installation procedures with paragraph 2-23. If the monitor bridge is already installed, or the recorder has been ordered without one, replace the recorder rear panel.

2-23 HEAD INSTALLATION

2-24 The Mark Ten Head Assembly is shipped in its own protective container, and must be mounted on the recorder by the user. Before installing the head, determine that it has the correct characteristics for use in a VR-1200B recorder:

a. Air-bearing equipped (not ball bearings - although ball-bearing equipped heads may be used in the recorder, the head normally supplied is equipped with air bearings).

b. Transistor preamplifiers (red label).

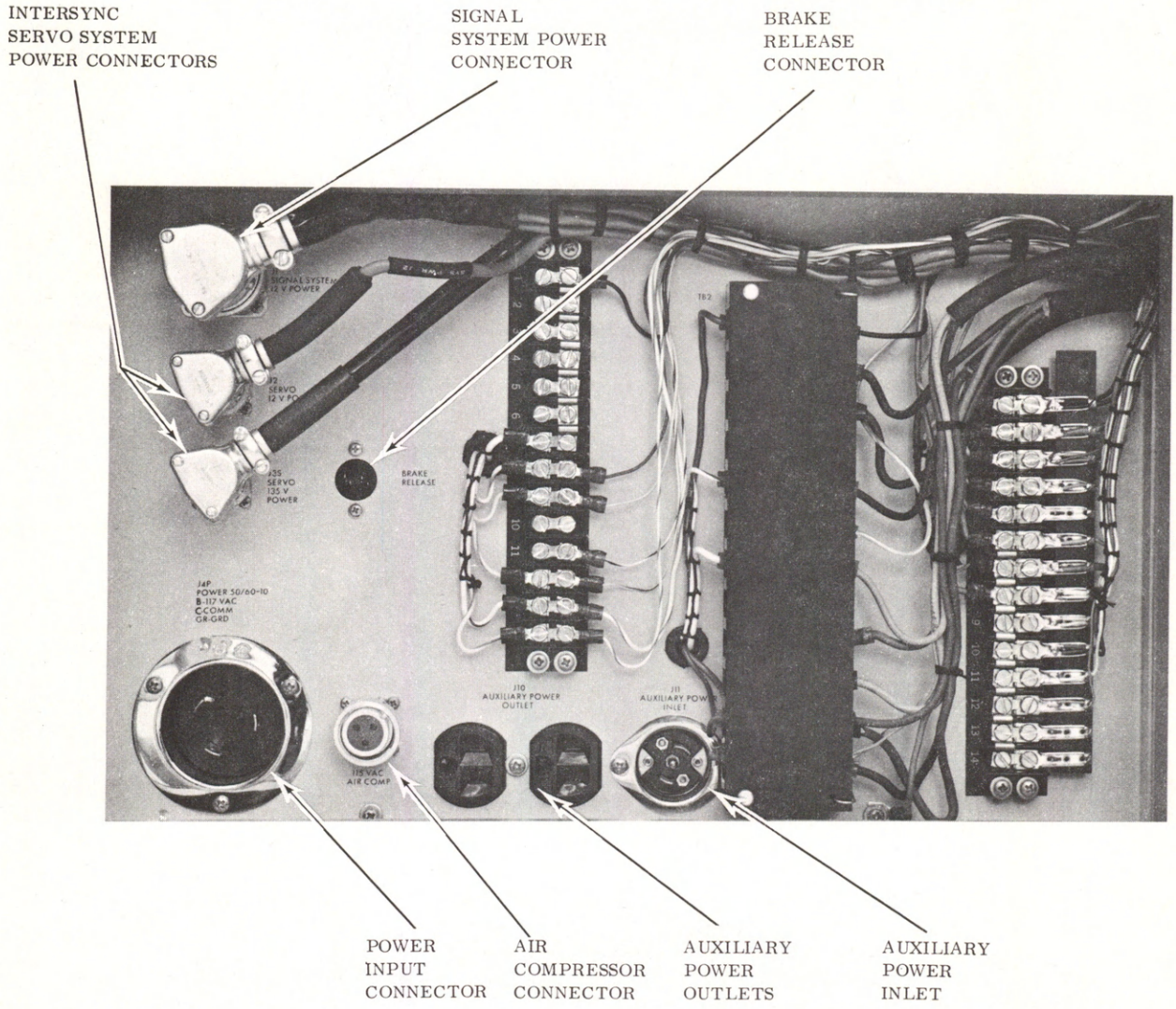


Figure 2-2. Power Distribution Panel

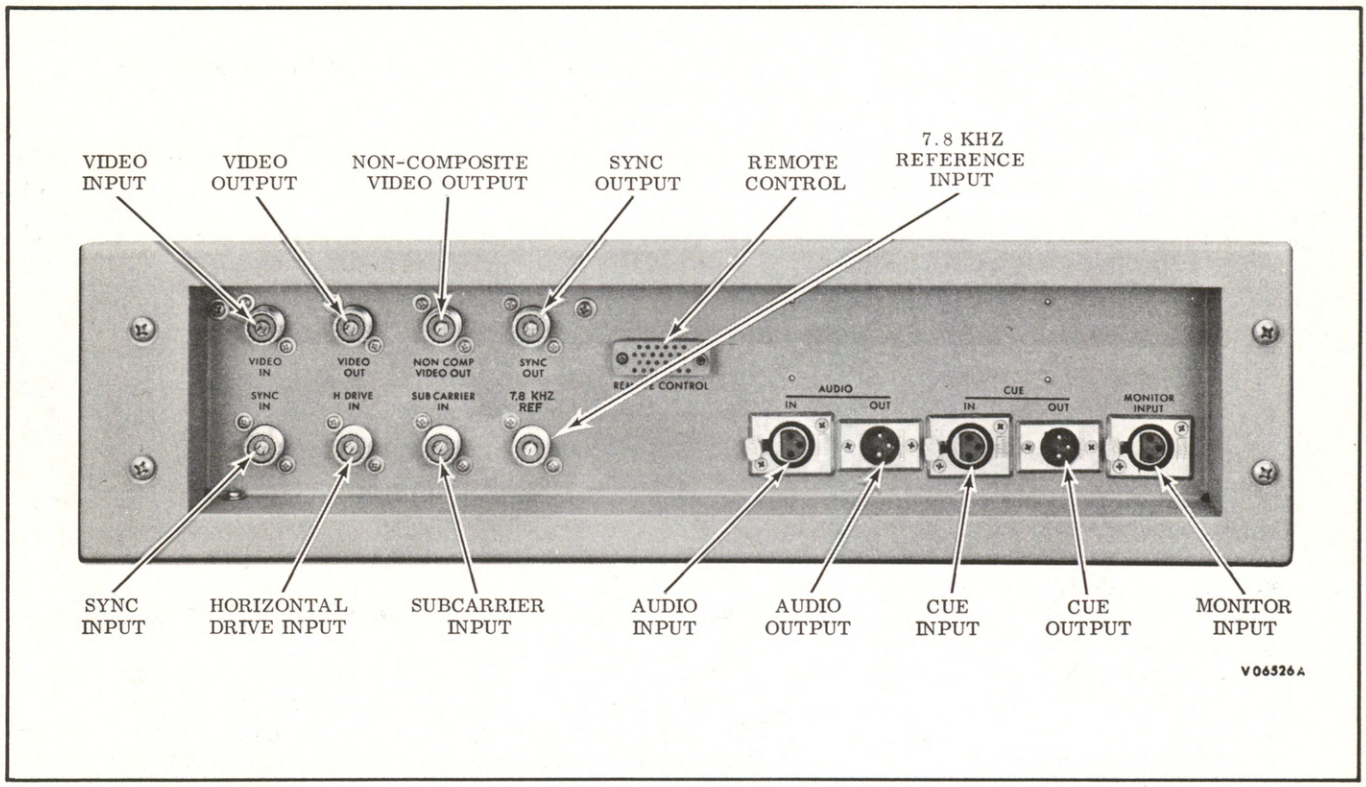


Figure 2-3. External Connector Panel

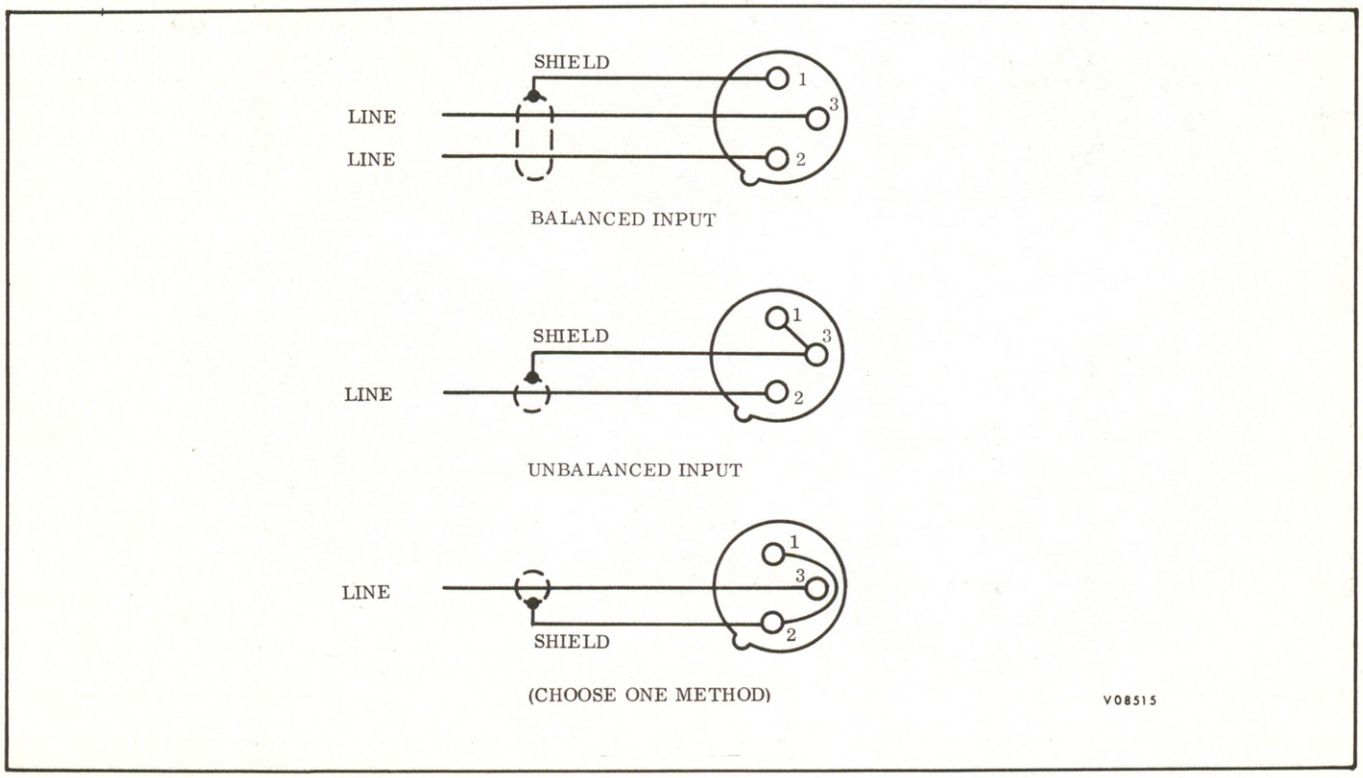


Figure 2-4. Audio and Cue Connections

c. Proper head tip width (5-mil for 7.5 ips; 5-mil or 10-mil for 15 ips).

2-25 Mount the head assembly to the recorder using two 50074 mounting screws supplied with the recorder and the mounting screw held captive in the head preamplifier assembly (see Figure 4-9).

CAUTION

USE CARE WHEN MOUNTING THE HEAD TO AVOID BENDING ANY OF THE CONNECTOR PINS. TO AVOID WARPING THE HEAD PLATE, TIGHTEN ALL SCREWS "FINGER TIGHT", THEN TIGHTEN THE TWO SCREWS AT THE RIGHT-HAND SIDE OF THE HEAD. TIGHTEN THE SCREW AT THE LEFT-HAND SIDE OF THE HEAD LAST.

2-26 REMOTE CONNECTIONS

2-27 Some of the following remote control accessories require a connection to J9 (REMOTE CONTROL) on the recorder external control panel; the mating connector for J9 is a 26 pin male connector 145-208 supplied with the recorder.

2-28 Tape Transport Remote Control

2-29 The tape transport remote control accessory 1810924 may be connected through an extension cable to J9 on the recorder external connector panel. Table 2-1 lists the cable connections required between the remote control unit and the recorder.

2-30 Processing Amplifier Remote Control

2-31 The processing amplifier remote control accessory 51880 (-05 or higher) may be connected through an extension cable to J9 on the recorder external connector panel. Table 2-2 lists the cable connections required between the processing amplifier remote control unit and the recorder.

2-32 Tape Speed Override Remote Control

2-33 The tape-speed override remote control accessory is connected through an extension cable to J9 on the recorder external connector panel. Figure 2-5 shows a schematic diagram of a tape-speed override remote control unit; the unit is essentially the same as the tape=speed override control on the Intersync servo front panel. If a processing amplifier remote control is also being used, both remote control units will connect to pin N (positive 12 volts) and pin V (negative 12 volts) of P9.

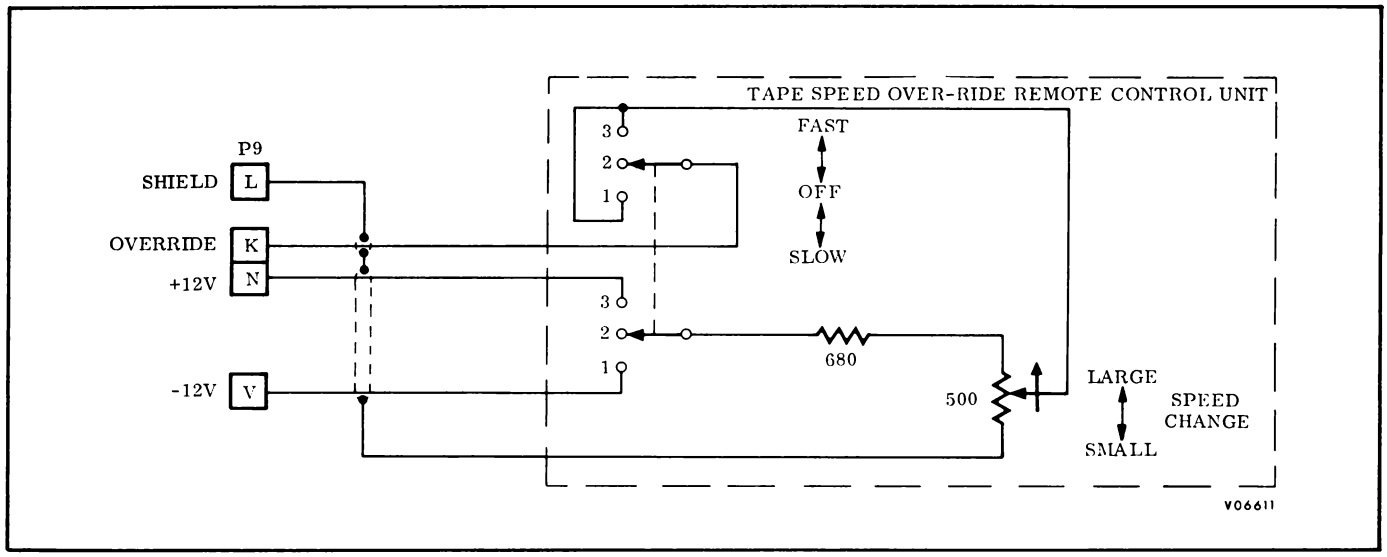


Figure 2-5. Tape Speed Overrides, Schematic Diagram

Table 2-1. Transport Remote Control Cable

FROM TRANSPORT REMOTE CONTROL UNIT TB1	TO REMOTE CONNECTOR P9 (VR-1200)	FUNCTION
9	A	Remote record
12	B	Remote play
4	C	Remote rewind
14	D	Remote record common
3	E	Remote stop
7 & 8	H	Remote fast forward and remote fast forward lamp
5	J	Remote rewind lamp
1 & 6	M	+24V to remote
2	X	Remote stop lamp
10 & 11	CC	Remote play and remote play lamp
13	DD	Remote record lamp

Table 2-2. Processing Amplifier Remote Control Cable

FROM PROCESSING AMPLIFIER REMOTE CONTROL UNIT P1	TO REMOTE CONNECTOR P9 (VR-1200)	FUNCTION
1	M	Remote +24V
8	N	Remote Pedestal (+12V)
7	P	Remote pedestal gain
9	R	Remote sync gain
3	S	Remote 24V common
6	T	Remote video gain variable
5	U	Remote video gain +
4	V	Remote video gain - (-12V)
10	W	Remote pedestal +
2	Y	Remote processor lamp

2-34 Indicator Connections

2-35 A red indicator on the tape transport top plate, between the two tape reel turntables, may be used as an on-the-air indicator, a record mode indicator, or for any other purpose desired. The lamp supplied with the recorder operates from approximately 24 volts, ac or dc. Connections to the lamp are made through pins AA and BB (both isolated from ground) and pin Z (shield) of J9 on the recorder external connector panel.

2-36 Foot Operated Brake Release

2-37 The locations of the two foot brake connectors are shown in Figures 1-1 and 2-2. The connector is located on the bottom of the recorder. The mating connector is a Harvey Hubbell 7594 or equivalent. The mating connector for the connector at the rear of the system power supply is a Cinch-Jones P302 CCT L or equivalent. Ampex foot switch number 120-988 or any standard single-pole, single- or double-throw spring-return foot switch may be used (Linemaster T51S or equivalent). Connect the common terminal of the foot switch to one terminal of the connector, and the normally-open terminal of the foot switch to the other connector terminal. The normally-closed contact of the foot switch and the center pin of the connector on the bottom of the recorder are not used.

NOTE

The two connectors on the recorder are in parallel, and either may be used.

2-38 Monitor Bridge Installation

2-39 Instructions for mounting and connecting the monitor bridge accessory are found in the separate monitor bridge manual 1809985.

2-40 220 Volt Power Panel Installation (Standard with International Version)

2-41 Before mounting the 220 volt power panel, measure the line voltage at the recorder site. Connect the wire from the circuit breaker of the power panel to the appropriate tap on the auto-transformer (210, 220, 230, 240, or 250 volts). Be sure the line voltage is single phase, 50 or 60 hertz.

2-42 Mount the power panel in accordance with the following instructions:

a. Remove the trim panel at the lower right corner of the rear of the recorder (see Figure 2-1); save the mounting hardware.

b. Mount the power panel in the space shown in Figure 2-1 using four #12-24 x 3/8- in. Phillips-head screws; do not use screws in mounting holes where interference with the trim panel is possible.

c. Replace the trim panel.

2-43 Connect the output (female) cable of the power panel to the input connector of the system power panel. Connect the power input cable to the connector on the 220-volt power panel. (Connect the high side of the line to pin X, the low side of the line to pin Z, and the power ground to pin GR. No connection is made to pin Y.)

2-44 Intersync Servo Capture Range Defeat

2-45 The Intersync servo system is normally shipped from the factory with the capture range extension circuits connected; this allows the servo system to lock to external reference signals which may deviate more than one-half hertz from the nominal reference frequencies. This capability is available at the cost of slightly increased starting time of the tape system (refer to Table 1-1).

2-46 The following procedures should be followed if the user wishes to disable the capture range extension circuits:

a. Remove module 5 from the Intersync servo chassis by loosening the two screws at the top and bottom of the module.

b. Remove resistor R75.

c. Replace module 5.

d. Remove module 12 from the Intersync servo chassis.

e. Remove resistor R32.

f. Replace module 12.

SECTION III

OPERATION

SECTION III

OPERATION

3-1 SCOPE

3-2 This section provides a description of all operating controls and indicators and operating instructions for the VR-1200B. Prior to operation, personnel must be familiar with this section.

3-3 OPERATING CONTROLS AND INDICATORS

3-4 Figure 3-1 shows the location of the assemblies on which the various controls and indicators are located. Subsequent illustrations show the locations of the controls themselves.

3-5 System Power Supply

3-6 The locations of the system power supply operating controls and indicators are shown in Figure 3-2. Table 3-1 describes their functions.

3-7 Main Control Panel

3-8 Most of the tape transport operating controls and indicators and the primary operating controls and indicators of the recorder are located on the main control panel. Indicators are also located on the main control panel to warn of system malfunctions. Figure 3-3 shows the locations of the controls and indicators on the main control panel. Table 3-2 describes their functions.

3-9 Tape Transport

3-10 The operating controls and indicators on the tape transport are shown in Figure 3-4 and described in Table 3-3.

3-11 Video Signal System Chassis

3-12 All operating controls and indicators are accessible at the front of the video signal system chassis. The control panel located on the upper portion of the chassis contains all main operating controls of the signal system. Figure 3-5 shows the operating controls and indicators of the signal system chassis and all available accessory modules. Table 3-4 describes the function of each control or indicator.

3-13 Intersync Servo System Chassis

3-14 The primary operating controls and indicators of the Intersync servo system are located on the Intersync control panel; the secondary controls and indicators are located on the individual modules. Figure 3-6 shows the location of the primary controls and indicators and Table 3-5 describes their functions.

3-15 Audio and Cue Chassis

3-16 The locations of the audio and cue chassis operating controls and indicators are shown in Figure 3-7. Table 3-6 describes the function of each control and indicator. In addition to controls and indicators, the audio and cue chassis contains a hand-held retractable microphone.

3-17 Processing Amplifier

3-18 The operating controls of the processing amplifier are located on the right-hand side of the processing amplifier chassis. Figure 3-8 shows the location of the controls, and Table 3-7 describes their functions.

3-19 Amtec (Accessory)

3-20 The locations of the Amtec accessory operating controls and indicators are shown in Figure 3-9. Table 3-8 describes their functions.

3-21 Colortec (Accessory)

3-22 The locations of the Colortec accessory operating controls and indicators are shown in Figure 3-10. Table 3-9 describes their functions.

3-23 Universal Colortec (Accessory)

3-24 The locations of the Universal Colortec accessory operating controls and indicators are shown in Figure 3-11. Table 3-10 describes their functions.

3-25 Automatic Velocity Compensator (Accessory)

3-26 Figure 3-12 shows the location of the only velocity compensator operating control, the VELOCITY COMPENSATION switch. To place the unit into operation, set this two-position rotary switch to ON.

3-27 Monitor Switch Panel

3-28 The monitor switch panel controls the selection of signals to be displayed by the video or waveform monitor, or emitted by the audio monitor. The monitor switch panel also contains controls and indicators for the Mark II Editec and Mark III Electronic Editor, when these accessories are included in the system. Figure 3-13 shows the locations of the controls and indicators, and Table 3-11 describes their functions.

3-29 Audio Monitor

3-30 Figure 3-14 shows the location of controls for the audio monitor, and Table 3-12 describes their functions.

3-31 Video Monitor

3-32 Figure 3-15 shows the locations of controls for the video monitor, and Table 3-13 describes their functions.

3-33 Waveform Monitor

3-34 Figure 3-16 shows the locations of controls and indicators of the waveform monitor, and Table 3-14 describes their functions.

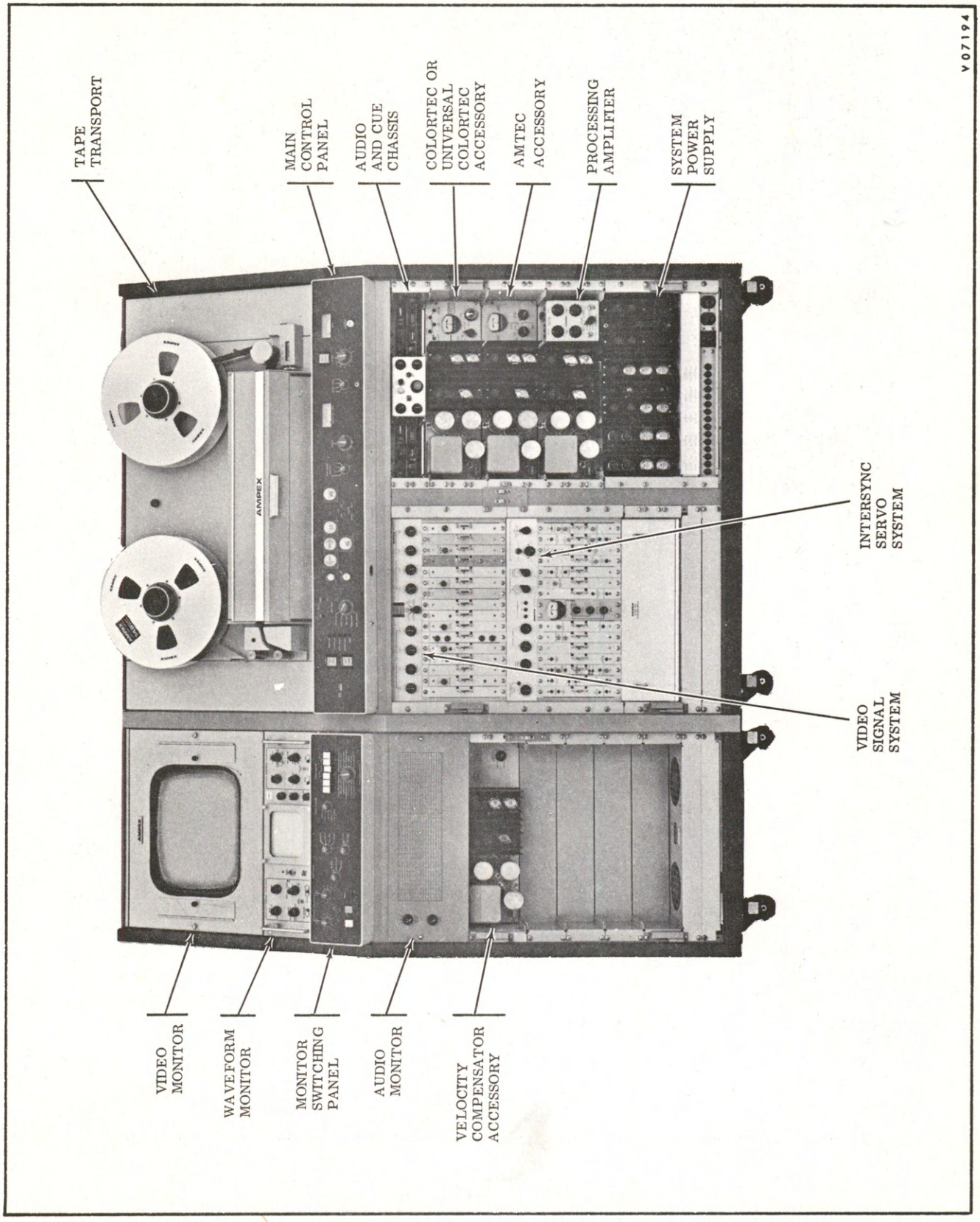
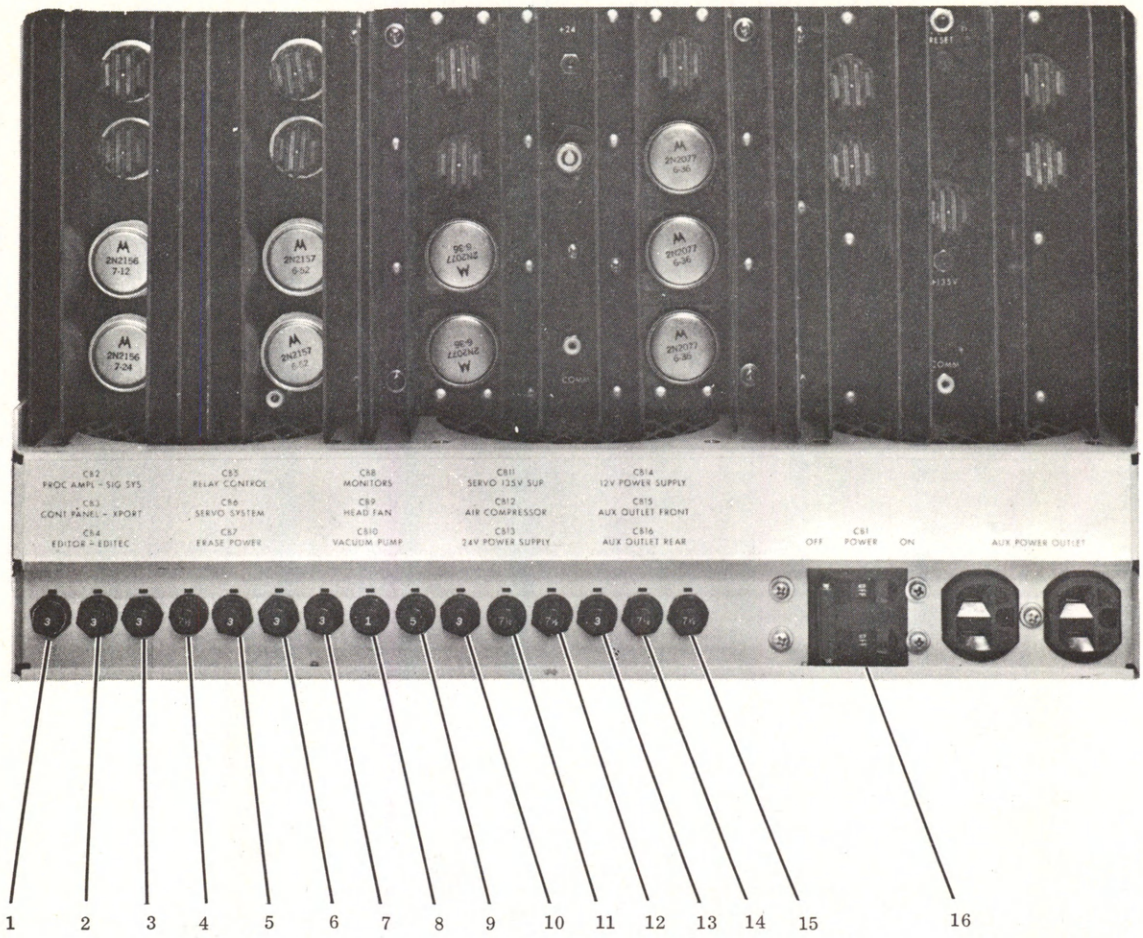


Figure 3-1. Assembly Locations



1 PROCessing AMPLifier - SIGnal SYStem breaker
2 CONTrol PANEL - XPORT breaker
3 EDITOR-EDITEC breaker
4 RELAY CONTROL breaker
5 SERVO SYSTEM breaker
6 ERASE POWER breaker
7 MONITORS breaker
8 HEAD FAN breaker
9 VACUUM PUMP breaker
10 SERVO 135V SUPply breaker
11 AIR COMPRESSOR breaker
12 24V POWER SUPPLY breaker
13 12V POWER SUPPLY breaker
14 AUXiliary OUTLET FRONT breaker
15 AUXiliary OUTLET REAR breaker
16 Main POWER breaker
17 Overload indicator (135V)
18 RESET switch (135V)

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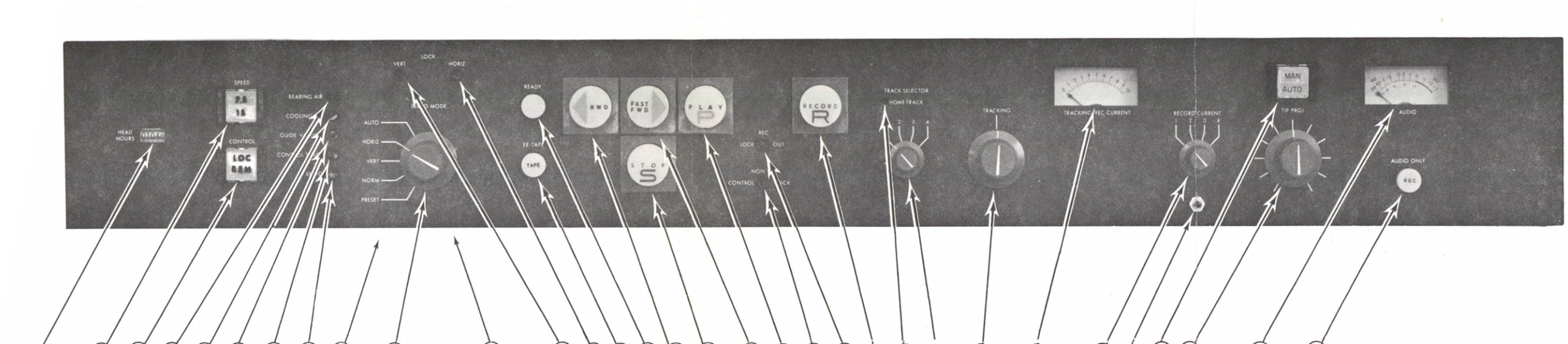
Figure 3-2. System Power Supply Controls and Indicators

Table 3-1. System Power Supply Operating Controls and Indicators

FIGURE 3-2 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1	PROCessing AMPLifier - SIGnal SYStem circuit breaker CB2	3 amp circuit breaker and indicator. Protects and controls +24V power to the video signal system and processing amplifier
2	CONTrol PANEL-XPORT circuit breaker CB3	3 amp circuit breaker and indicator. Protects and controls +24V power to the control panel and tape transport
3	EDITOR-EDITEC circuit breaker CB4	3 amp circuit breaker and indicator. Protects and controls +24V power to the editor and editec accessories
4	RELAY CONTROL circuit breaker CB5	7.5 amp circuit breaker and indicator. Protects and controls +24V power to the system control unit
5	SERVO SYSTEM circuit breaker CB7	3 amp circuit breaker and indicator. Protects and controls +24V power to the Intersync servo system
6	ERASE POWER circuit breaker CB6	3 amp circuit breaker and indicator. Protects and controls +24V power to the erase driver
7	MONITORS circuit breaker CB8	3 amp circuit breaker and indicator. Protects and controls 117V ac power to the monitor bridge accessory
8	HEAD FAN circuit breaker CB9	1 amp circuit breaker and indicator. Protects and controls 117V ac power to the head fan motor
9	VACUUM PUMP circuit breaker CB10	5 amp circuit breaker and indicator. Protects and controls 117V ac power to the vacuum pump motor
10	SERVO 135V SUPply circuit breaker CB11	3 amp circuit breaker and indicator. Protects and controls 117V ac power to the +135V servo system power supply (part of the system power supply)
11	AIR COMPRESSOR circuit breaker CB12	7.5 amp circuit breaker and indicator. Protects and controls 117V ac power to the bearing air compressor motor
12	24V POWER SUPPLY circuit breaker CB13	7.5 amp circuit breaker and indicator. Protects and controls 117V ac power to the +24V relay power supply (part of the system power supply)

Table 3-1. System Power Supply Operating Controls and Indicators (Continued)

FIGURE 3-2 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
13	12V POWER SUPPLY circuit breaker CB14	3 amp circuit breaker and indicator. Protects and controls 117V ac power to the + and -12V signal system/ Intersync power supply (part of the system power supply)
14	AUXiliary OUTLET FRONT circuit breaker CB15	7.5 amp circuit breaker and indicator. Protects and controls 117V ac power from an auxiliary input to the front panel AUX POWER OUTLET connectors
15	AUXiliary OUTLET REAR circuit breaker CB16	7.5 amp circuit breaker and indicator. Protects and controls 117V ac power from an auxiliary input to the rear panel AUX POWER OUTLET connectors
16	Main POWER circuit breaker CB1	Dual 30 amp circuit breaker. Protects and controls 117V ac power for the entire recorder
	NOTE If the recorder is equipped with a 220V power panel (standard with the international version), the total system power is controlled by a circuit breaker on the power panel (see Figure 2-1). However, the main POWER circuit breaker may be used unless the recorder is to be kept off for an extended period.	
17	Overload indicator (+135V)	Red indicator. Indicates that an overload has occurred at the Intersync servo system, and that the power supply is no longer supplying +135V head drum power.
18	RESET switch (+135V)	Pushbutton switch. After the power supply overload is removed, this switch must be pressed to restore the +135V power supply to normal operation



1. HEAD HOURS meter
2. Tape SPEED switch and indicator
3. LOCal/REMote CONTROL switch and indicator
4. BEARING AIR warning indicator
5. COOLING AIR warning indicator
6. GUIDE VACUUM warning indicator
7. CONTROL TRACK warning indicator
8. SERVO warning indicator
9. Warning indicator test switch
10. SERVO MODE selector
11. A/B switch
12. VERTical servo LOCK indicator
13. HORIZontal servo LOCK indicator
14. EE-TAPE switch and indicator
15. READY switch and indicator
16. RWD switch and indicator
17. STOP switch and indicator
18. FAST FWD switch and indicator
19. PLAY switch and indicator
20. NON STD CONTROL TRACK indicator
21. RECord LOCK OUT indicator
22. RECORD switch and indicator
23. HOME TRACK indicator
24. TRACK SELECTOR
25. TRACKING control
26. TRACKING-RECord CURRENT meter
27. RECORD CURRENT selector
28. RECORD OPTIMIZE switch
29. TIP PROJection MAN/AUTO switch and indicator
30. TIP PROJection control
31. AUDIO meter
32. AUDIO ONLY RECord switch and indicator

Figure 3-3. Main Control Panel Controls and Indicators

Table 3-2. Main Control Panel Operating Controls and Indicators

FIGURE 3-3 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1	HEAD HOURS meter	Indicates total record and playback time
2	Tape SPEED switch and indicator	Illuminated 2-part pushbutton switch. Selects tape speed, and indicates the speed selected
3	LOCal/REMote CONTROL switch and indicator	Illuminated 2-part pushbutton switch. Transfers control of the tape transport to a remote location and indicates the control position
		NOTE The transfer of control to a remote location disables the local controls except for the STOP pushbutton.
4	BEARING AIR warning indicator	Red indicator. Lights when air bearing system pressure is below 50 (±2) psi or above 55 (±2) psi (if an air bearing-type head is mounted)
5	COOLING AIR warning indicator	Red indicator. Lights when cooling air is not drawn through the video head motor
6	GUIDE VACUUM warning indicator	Red indicator. Lights when guide vacuum is below 30 (±2) in. or above 50 (±2) in. H2O at the vacuum guide of the video head assembly
7	CONTROL TRACK warning indicator	Red indicator. Lights when the control track level in record or playback is lower than the established optimum level. Also lights or flashes if the edit pulse is absent during edit operation
8	SERVO warning indicator	Red indicator. Lights when the drum servo is not locked to the appropriate reference signal in record or playback
9	Warning indicator test switch	Pushbutton switch. Applies power to test the operation of the warning indicators
10	SERVO MODE selector	Five-position rotary switch. Selects reference signal for the Intersync servo system; in all positions except PRESET, this selection is for playback mode only. (During record, the servo is referenced to vertical sync pulses of the incoming video signal.)

Table 3-2. Main Control Panel Operating Controls and Indicators (Continued)

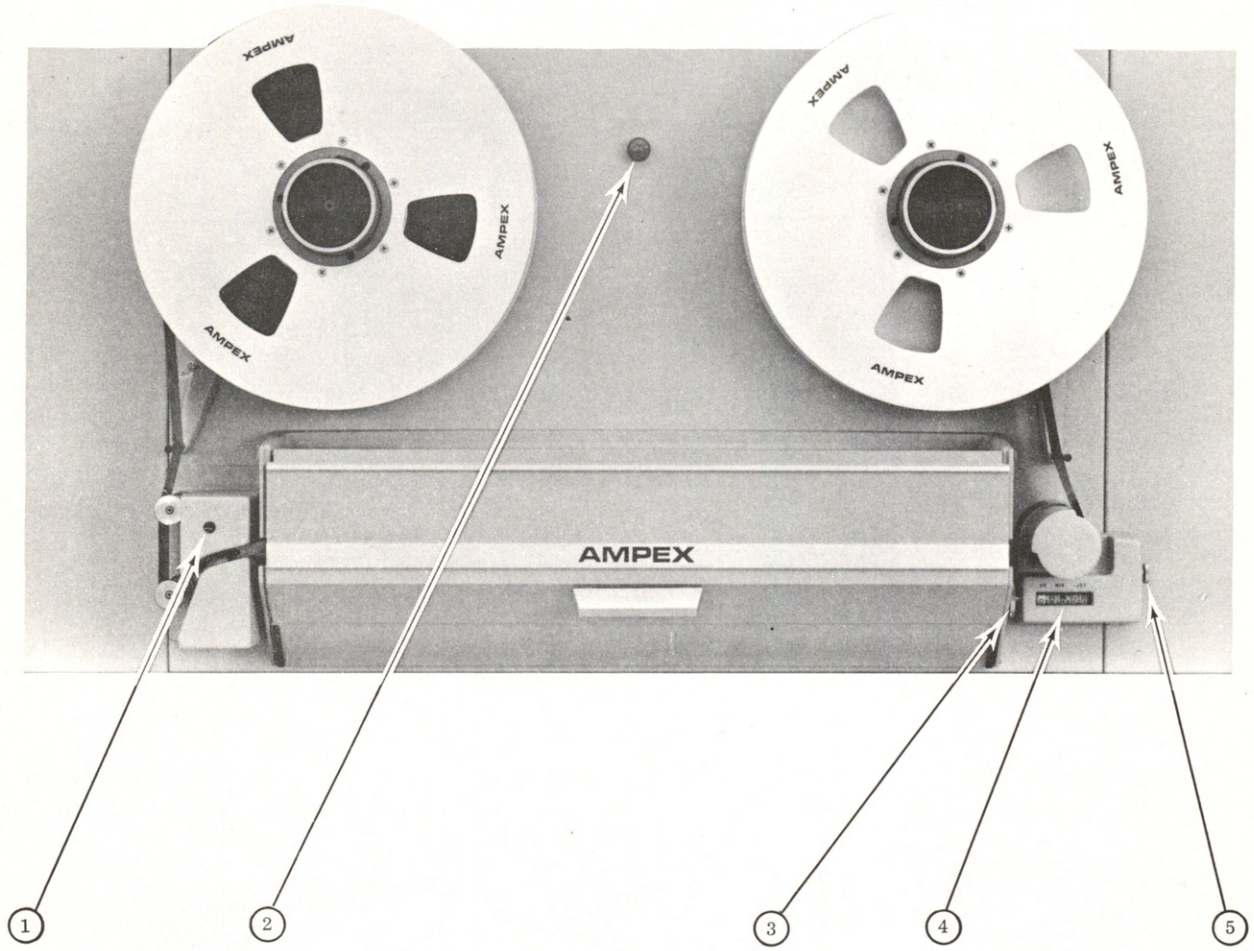
FIGURE 3-3 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
10 (Cont)	AUTO position	Automatic mode; the reproduced video is tightly locked (vertically and horizontally) to local reference sync.
	HORIZ position	Horizontal mode; the reproduced video is tightly locked to local reference horizontal sync
	VERT position	Vertical mode; the reproduced vertical sync pulses are tightly locked to the local reference vertical sync pulses, and the reproduced horizontal sync is frame-locked to local horizontal sync (within one horizontal line). Roll-free switching between reproduced video and other video sources is possible in this mode.
	NORM position	Normal mode; the reproduced video is loosely locked to power line frequency
	PRESET position	Preset mode; the servo reference is selected by the PRESET REFERENCE SELECTOR controls on the servo system panel
11	A/B switch	Pushbutton switch. Parallels the EE-TAPE switch and is used to compare the reproduced video signal with the input video signal
12	VERTical servo LOCK indicator	Green indicator. Lights in the play mode to indicate that the servo mode selected is either vertical or automatic, and that the tape vertical sync is coincident with the reference vertical sync (odd fields aligned with odd fields)
13	HORIZontal servo LOCK indicator	Green indicator. Lights in the play mode to indicate that the servo mode selected is either horizontal or automatic, and that tape horizontal sync is coincident with the reference horizontal sync (±2 Usec)
14	EE-TAPE switch and indicator	Illuminated pushbutton switch. Either routes the modulator output to the demodulator input - electronics-to electronics (e-e) mode - or selects the output of signal system module 7. Lights when the tape (switcher output) mode is selected. May be set to TAPE position to find audio cues on the tape in stop, fast forward, and rewind modes.

Table 3-2. Main Control Panel Operating Controls and Indicators (Continued)

FIGURE 3-3 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
15	READY switch and indicator	Illuminated pushbutton switch. Applies power to the head drum and capstan motors and allows the drum servo to lock-up. Lights when the ready mode is selected.
16	RWD switch and indicator	Illuminated pushbutton switch. Places the tape transport in the rewind mode. Lights when the rewind mode is initiated
17	STOP switch and	Illuminated pushbutton switch. Deactivates the tape transport circuits and stops tape movement. Lighted when the tape is threaded but stopped
18	FAST FWD switch and indicator	Illuminated pushbutton switch. Places the tape transport in the fast forward mode. Lights when the fast forward mode is initiated
19	PLAY switch and indicator	Illuminated pushbutton switch. Places the tape transport and playback circuits in operation. Lights when the play mode is selected
20	NON STD CONTROL TRACK indicator	Amber indicator. Lights to indicate that the NON-STANDARD tracking control of the Intersync servo system is in use. Only operates in the play mode and when the servo mode selector is set to the automatic mode
21	RECord LOCK OUT indicator	Amber indicator. Lights to indicate that the interlock circuits are in operation. Interlock circuits prevent the recorder from operating in the record mode should video-head guide vacuum be below 30 (±2) in. H2O or should a master tape reel close the supply reel record lock-out switch
22	RECORD switch and indicator	Illuminated pushbutton switch. Places the record circuits in operation. To prevent accidental record mode initiation, the play button must be held depressed when the RECORD button is pressed. The button will light when the record mode is initiated
23	HOME TRACK indicator	Green indicator. Lights to indicate that the non-standard track circuits are not activated and that head number 4 is reproducing the track containing vertical sync

Table 3-2. Main Control Panel Operating Controls and Indicators (Continued)

FIGURE 3-3 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
24	TRACK SELECTOR	Four-position rotary switch. Selects the track to which the TRACKING control will optimize
25	TRACKING control	Controls video head-to-track position
26	TRACKING-RECord CURRENT meter	In the record mode the meter indicates record current. In the play mode it indicates playback rf level to allow adjustment for optimum tracking
27	RECORD CURRENT selector	Four-position rotary switch. Selects the channel to be monitored by the TRACKING-RECord CURRENT meter in record mode; also selects head to be optimized if system is equipped with video head optimizer accessory
28	RECORD OPTIMIZE switch (accessory)	Pushbutton switch. Enables head optimizing circuitry when recorder is in record mode
29	TIP PROJection MAN/AUTO switch and indicator	Illuminated 2-part pushbutton switch. Manual mode disables the automatic circuits and allows the position of the vacuum guide to be adjusted by the TIP PROJ control. The MANual portion of the 2-section switch lights to indicate selection of this mode. The AUTOmatic portion activates the automatic guide servo system
30	TIP PROJection control	Allows manual control of the vacuum guide position
31	AUDIO meter	Indicates audio or cue levels in record or play modes
32	AUDIO ONLY RECord switch and indicator	Illuminated pushbutton switch. Allows the insertion of new audio to existing recordings without disturbing the video or control tracks



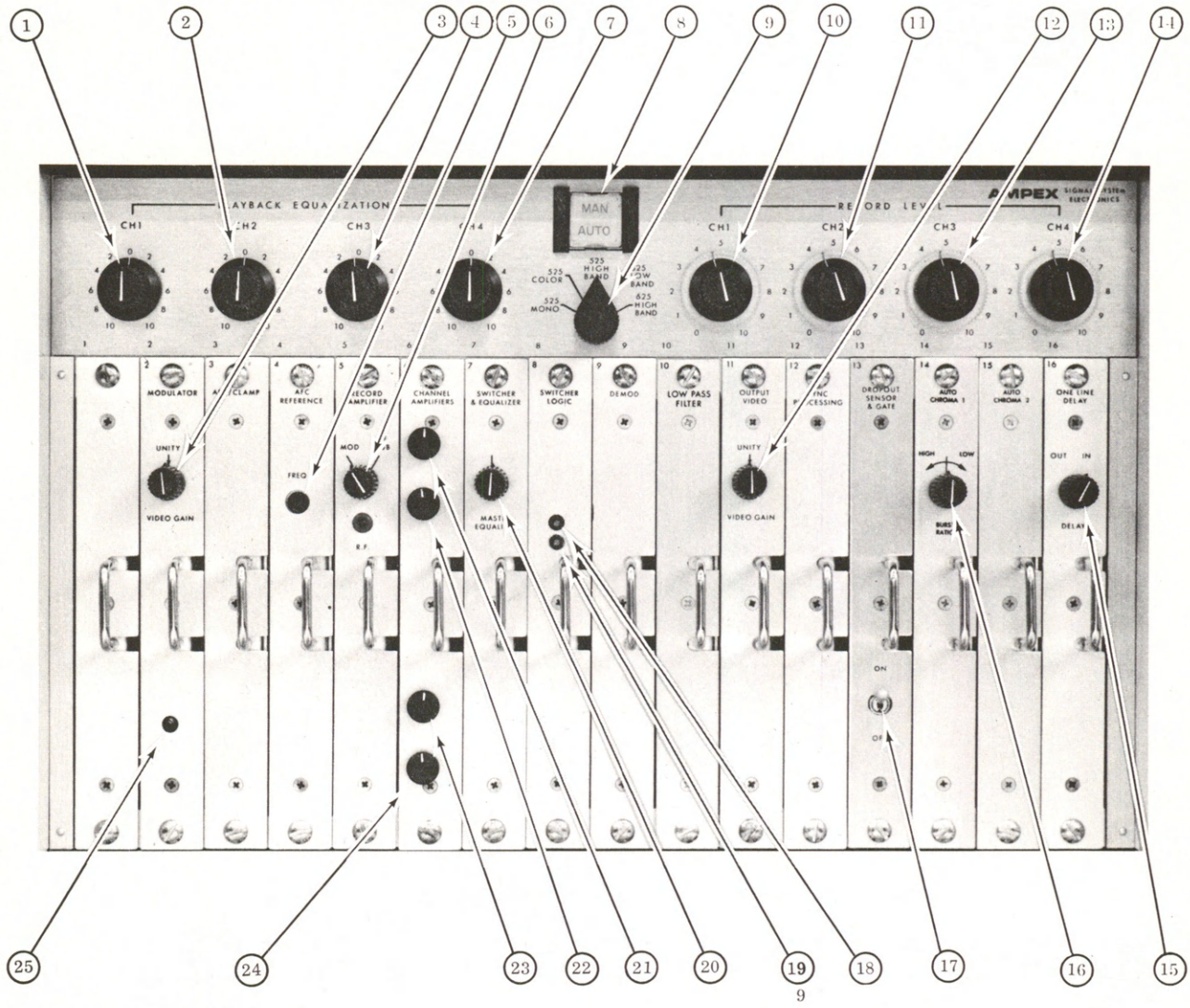
1. ERASE INDICATOR
2. UTILITY INDICATOR
3. TAPE TIMER RESET KNOB
4. TAPE TIMER
5. TAPE TIMER ADJUSTMENT KNOB

V07195

Figure 3-4. Tape Transport Controls and Indicators

Table 3-3. Tape Transport Operating Controls and Indicators

FIGURE 3-4 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1	Erase indicator	Lights when the video erase head is energized and operating properly
2	Utility indicator	Lights when an external energizing voltage is applied; may be used as an on-the-air indicator, fault indicator, etc.
3	Tape Timer reset knob	Used to manually reset the tape timer to zero
4	Tape Timer	Reads elapsed time directly at 15 ips. At a forward tape speed of 7.5 ips, total elapsed tape time will be twice what the meter indicates
5	Tape Timer adjustment knob	Pull and turn control. Used to adjust time reading without resetting entire unit to zero



9

1. CHannel 1 PLAYBACK EQUALIZATION control
2. CHannel 2 PLAYBACK EQUALIZATION control
3. VIDEO GAIN control
4. CHannel 3 PLAYBACK EQUALIZATION control
5. FREQuency warning indicator
6. MOD/RF DUB selector
7. CHannel 4 PLAYBACK EQUALIZATION control
8. Auto-chroma MAN/AUTO switch and indicator
9. Video standards selector
10. CHannel 1 RECORD LEVEL control
11. CHannel 2 RECORD LEVEL control
12. VIDEO GAIN control
13. CHannel 3 RECORD LEVEL control
14. CHannel 4 RECORD LEVEL control
15. DELAY switch
16. BURST RATIO control
17. Dropout sensor ON/OFF switch
18. Tachometer phasing adjustment (525 line)
19. Tachometer phasing adjustment (625 line)
20. MASTER EQUALIZER control
21. Channel 1 differential gain control
22. Channel 2 differential gain control
23. Channel 3 differential gain control
24. Channel 4 differential gain control
25. Carrier frequency adjustment

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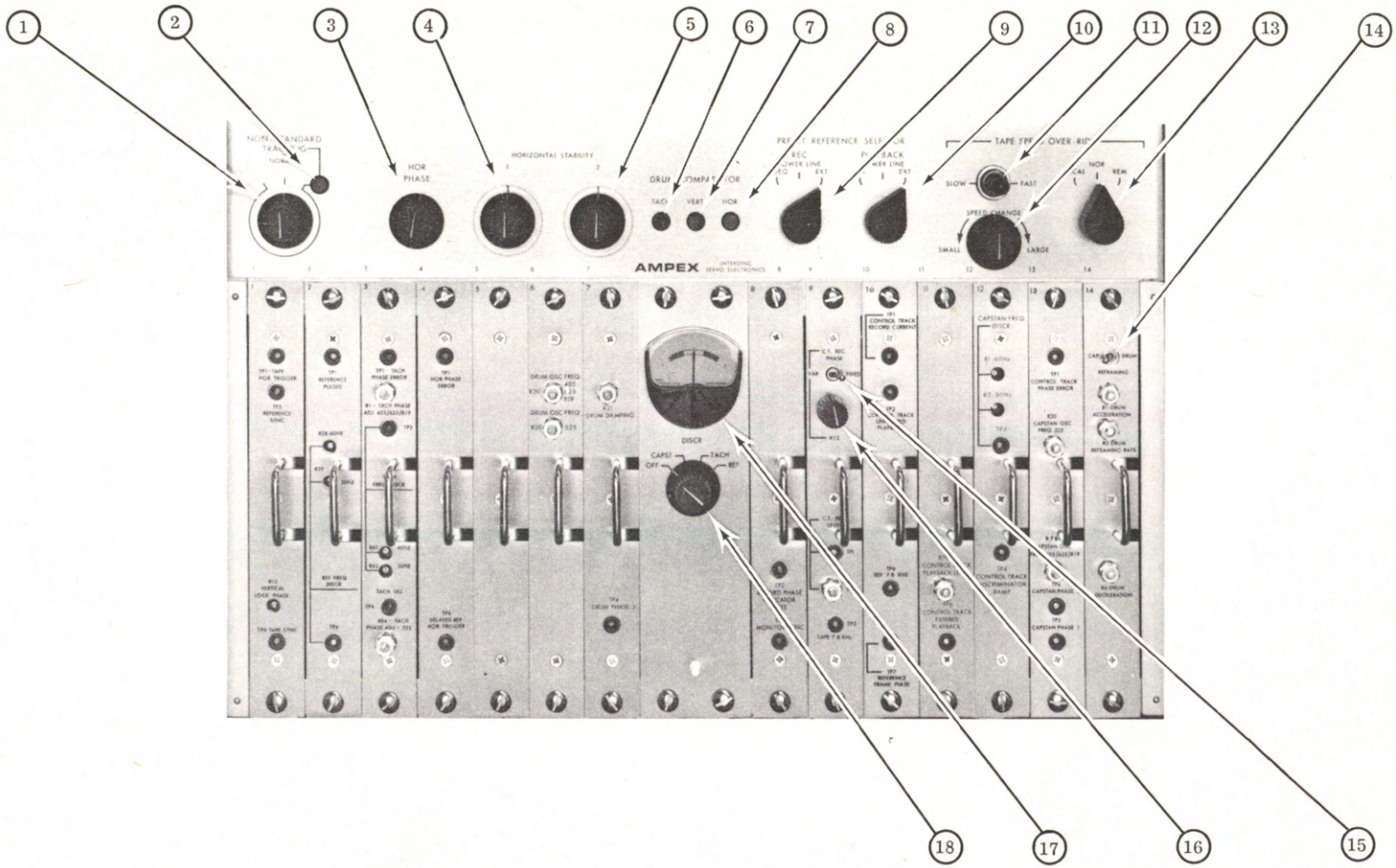
Figure 3-5. Video Signal System Controls and Indicators

Table 3-4. Video Signal System Operating Controls and Indicators

FIGURE 3-5 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1,2,4,and 7	PLAYBACK EQUALIZATION controls	The four controls provide individual head channel frequency response equalization during playback
3	VIDEO GAIN control	Controls the level of the input video signal. Optimum level of the input signal is 1V p-p. At UNITY setting, 1V p-p composite input will deviate the carrier to the proper frequencies
5	FREQuency warning indicator (accessory)	Red indicator. Lights to indicate that the modulator carrier oscillator is off frequency and beyond the correction range of the AFC circuits
6	MOD/RF DUB selector	Two-position rotary switch. Selects the source of rf in the record mode. The MOD position selects rf from the signal system modulator. The RF DUB position selects rf from an external source such as the demodulator signal (prior to detection) of a second recorder operating in the play mode
8	Auto-chroma MAN/AUTO switch and indicator (present in all systems, but used only in conjunction with the Auto-chroma accessory)	Illuminated 2-part pushbutton switch. Selects automatic or manual control of playback equalization. When in the manual mode, the indicator portion of the switch lights white and displays MAN. This mode allows manual control of playback equalization (Index Nos. 1, 2, 4, and 7). When in the automatic mode and no color signal is present, the indicator portion of the switch lights dim blue and displays AUTO. Playback equalization is manually controlled. In automatic mode, when a color signal is present, the indicator lights bright blue and playback equalization is controlled automatically by the Auto-Chroma accessory.
9	Video standards selector	Five-position rotary switch. Selects any of five video standards: 525 low-band monochrome, 525 low-band color, 525 high-band 625 low-band, or 625 high-band
10,11,13 and 14	RECORD LEVEL controls	Control the amount of record current in each individual video head

Table 3-4. Video Signal System Operating Controls and Indicators (Continued)

FIGURE 3-6 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
12	VIDEO GAIN control	Controls the output level of the video amplifier. Optimum level of the output signal is 1V p-p. UNITY gain assures 1V p-p composite output if a tape recorded to proper deviation limits is played
15	DELAY switch (accessory)	Two-position rotary switch. Places the one line delay accessory into operation
16	Auto-chroma BURST RATIO control (accessory)	Adjusts the threshold level of chroma agc so that recordings made with improper color burst level may be played back with the proper level of chroma
17	Dropout sensor ON/OFF switch	Toggle switch. Places the dropout sensor and gate into operation. Provides a white level calibration pulse for use with the afc accessory in record. Provides dropout compensation in conjunction with the one line delay accessory in playback
18 and 19	Tachometer phasing control	Adjusts the time at which head switching occurs
20	MASTER EQUALIZER control	Provides overall frequency response equalization of the playback circuits
21,22,23, and 24	Response Controls (accessory)	Adjusts the playback response of the four head channel amplifiers to minimize differental gain
25	Carrier frequency adjustment	Adjusts the modulator carrier frequency



1. NON-STANDARD TRACKING control
2. NON-STANDARD TRACKING indicator
3. HORizontal PHASE control
4. HORIZONTAL STABILITY 1 control
5. HORIZONTAL STABILITY 2 control
6. DRUM COMPARATOR TACH indicator
7. DRUM COMPARATOR VERTical sync indicator
8. DRUM COMPARATOR HORizontal sync indicator
9. RECord PRESET REFERENCE SELECTOR
10. PLAYBACK PRESET REFERENCE SELECTOR
11. TAPE SPEED OVER-RIDE speed selector
12. TAPE SPEED OVER-RIDE SPEED CHANGE control
13. TAPE SPEED OVER-RIDE control selector
14. REFRAMING switch
15. Control Track RECord PHASE switch
16. Control Track RECord PHASE control
17. DISCRiminator meter
18. DISCRiminator meter selector

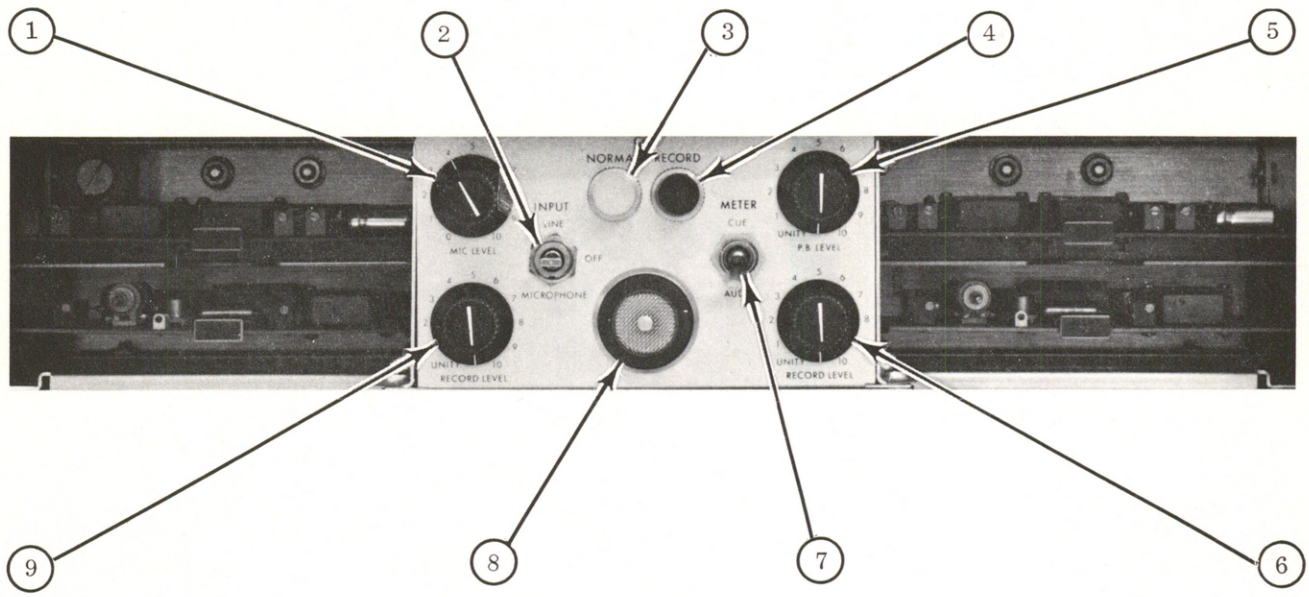
Figure 3-6. Intersync Servo System Controls and Indicators

Table 3-5. Intersync Servo System Operating Controls and Indicators

FIGURE 3-6 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1	NON-STANDARD TRACKING control	Provides a means of framing should tapes with non-standard control track phase be reproduced
2	NON-STANDARD TRACKING indicator	Amber indicator. Lights to indicate that the NON-STANDARD TRACKING control is in use (parallels item 20 of Table 3-2)
3	HORizontal PHASE control	Provides adjustment of the horizontal phase relationship during playback. Effective only when the mode selector on the main control panel is set to the AUTO or HORIZ positions
4 and 5	HORIZONTAL STABILITY 1 and HORIZONTAL STABILITY 2 controls	Provide adjustment of horizontal stability during playback. Used simultaneously. Effective only when the mode selector on the main control panel is set to the AUTO or HORIZ positions
6	DRUM COMPARATOR TACH indicator	Green indicator. Lights to indicate that the servo control signal is being provided by the phase comparator which compares the tachometer signal with incoming vertical sync or power line frequency.
7	DRUM COMPARATOR VERTical indicator	Green indicator. Lights to indicate that the servo control signal is being provided by the phase comparator which compares reproduced vertical sync with local reference vertical sync.
8	DRUM COMPARATOR HORizontal indicator	Green indicator. Lights to indicate that the servo control signal is being provided by the phase comparator which compares reproduced horizontal sync with local reference horizontal sync.
9	RECord PRESET REFERENCE SELECTOR	Three-position rotary switch. Provides selection of timing reference in the record mode. Effective only when the mode selector switch on the main control panel is in the PRESET position
10	PLAYBACK PRESET REFERENCE SELECTOR	Three-position rotary switch. Provides selection of timing reference in playback mode. Effective only when the mode selector switch on the main control panel is in the PRESET position.

Table 3-5. Intersync Servo System Operating Controls and Indicators (Continued)

FIGURE 3-6 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
11	TAPE SPEED OVER-RIDE speed selector	Momentary-contact, center-off toggle switch. Provides a momentary change of tape speed (at the rate selected by the SPEED CHANGE control) to allow lip-synchronization of two recorders. When set to SLOW, recorder slows down - when set to FAST, recorder speeds up
12	TAPE SPEED OVER-RIDE SPEED CHANGE control	Adjust the degree of speed change selected by the speed selector (item 11)
13	TAPE SPEED OVER-RIDE control selector	Three-position rotary switch. Selects LOCAL, NOR (normal), or REM (remote) control of the tape-speed over-ride circuits. In the LOCAL or REM positions, this control overrides the LOCal/REMote CONTROL selector on the main control panel (item 3 of Table 3-2)
14	REFRAMING switch	Toggle switch. Selects either the capstan or the head drum to perform reframing in playback. This switch is effective only when the SERVO MODE selector on the main control panel is set to AUTO or VERT
15	Control Track RECord PHASE switch	Toggle switch. Selects either fixed or variable control track record phase, a particularly useful capability when editing
16	Control Track RECord PHASE control	Adjust record phase of control track when C.T. RECord PHASE switch is set to VAR
17	DISCRiminator meter	Zero-center indicator. Indicates when signal selected by meter selector is at zero volts, or direction and approximate amplitude of error
18	DISCRiminator meter selector	Four-position rotary switch. Connects the null indicator to the output of the reference sync frequency discriminator (REF), the tachometer frequency discriminator (TACH), the capstan frequency discriminator (CAPST), or disconnects the meter entirely (OFF).



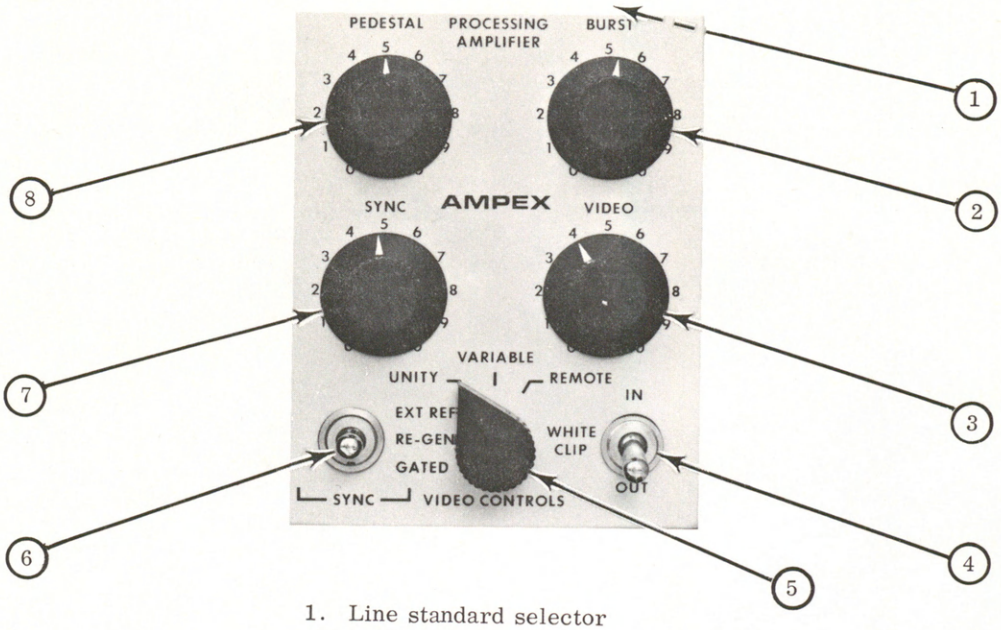
1. Cue channel MICrophone LEVEL control
2. Cue channel INPUT selector
3. CUE NORMAL switch and indicator
4. CUE RECORD switch and indicator
5. Audio channel P. B. LEVEL control
6. Audio channel RECORD LEVEL control
7. METER input selector
8. Retractable microphone
9. Cue channel RECORD LEVEL control

V7201

Figure 3-7. Audio and Cue Chassis Controls and Indicators

Table 3-6. Audio and Cue Chassis Operating Controls and Indicators

FIGURE 3-7 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1	Cue channel MICrophone LEVEL control	Provides control of the microphone level in the cue channel
2	Cue channel INPUT selector	Center-off toggle switch. Selects the origin of the cue channel signal-LINE or MICROPHONE
3	CUE NORMAL switch and indicator	Illuminated pushbutton switch. Lights to indicate the normal mode. Interlocked with the CUE RECORD switch and the transport controls. The cue channel in normal playback conditions remains in the normal mode. To record additional cue information during playback, the CUE RECORD pushbutton must be pressed. This mode is in effect until the CUE NORMAL pushbutton is pressed or the transport is stopped
4	CUE RECORD switch and indicator	Illuminated pushbutton switch. Lights red to indicate cue channel record condition. Interlocked with the CUE NORMAL pushbutton and the transport controls. When the transport is in the record mode, the cue channel is also in the record mode. To disable the cue channel record condition the CUE NORMAL pushbutton must be pressed
5	Audio channel P.B. LEVEL control	Controls the playback level of the audio channel
6	Audio channel RECORD LEVEL control	Controls the gain of the audio channel input amplifier
7	METER input selector	Toggle switch. Selects the audio or the cue signal to be monitored by the meter on the main control panel
8	Retractable microphone	Hand-held, high-impedance microphone. Allows the operator to record voice announcements on the cue channel
9	Cue channel RECORD LEVEL control	Controls the gain of the cue channel input amplifier



1. Line standard selector
2. BURST level control
3. VIDEO level control
4. WHITE CLIP switch
5. VIDEO CONTROLS selector
6. SYNC switch
7. SYNC level control
8. PEDESTAL level control

V7202

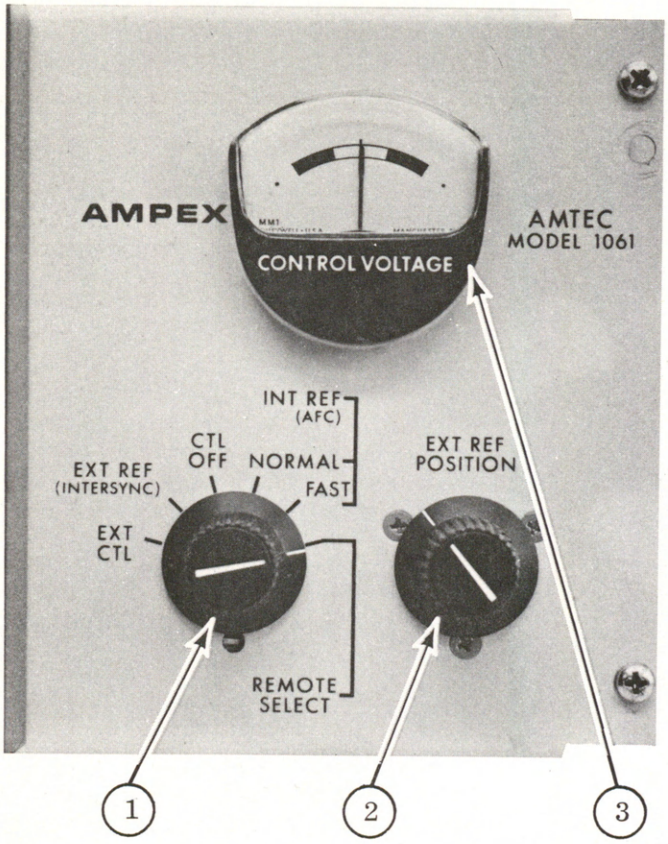
Figure 3-8. Processing Amplifier Operating Controls

Table 3-7. Processing Amplifier Operating Controls

FIGURE 3-8 INDEX NO.	CONTROL	FUNCTION
1	Line standard selector	Two-position rotary switch. Selects the line standard at which the processing amplifier operates (525 or 625 only)
2	BURST level control	Controls the level of the burst signal. Active only when the VIDEO CONTROLS switch is set at the VARIABLE position
3	VIDEO level control	Controls the level of the video signal. Active only when the VIDEO CONTROLS switch is set to the VARIABLE position
4	WHITE CLIP switch	Toggle switch. Controls the white clip circuits. The IN position limits the luminance signal to 110 IEEE units by clipping the white excursions. This action does not affect chrominance

Table 3-7. Processing Amplifier Operating Controls (Continued)

FIGURE 3-8 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
5	VIDEO CONTROLS selector	Three-position rotary switch. Allows selection of the processing amplifier operating mode. The UNITY setting will result in an output video signal level equal to incoming level (unity) with pedestal level remaining the same and sync level maintained at 0.286V p-p. The VARIABLE setting allows individual adjustment of the pedestal, video, sync, and burst levels. The REMOTE position allows video, pedestal, and sync to be controlled from a remote location
6	SYNC selector	Three-position toggle switch. Selects re-generated, external reference, or gated sync signals. Normally set at the GATED position unless the system is equipped with the Amtec time element compensator. Normally set at the RE-GEN or EXT REF position if the system is Amtec-equipped
7	SYNC level control	Controls the sync signal level. Active only when the VIDEO CONTROLS switch is set at the VARIABLE position
8	PEDESTAL level control	Controls the pedestal level. Active only when the VIDEO CONTROLS switch is set at the VARIABLE position



1. Function Selector
2. EXT REF POSITION Control
3. CONTROL VOLTAGE Meter

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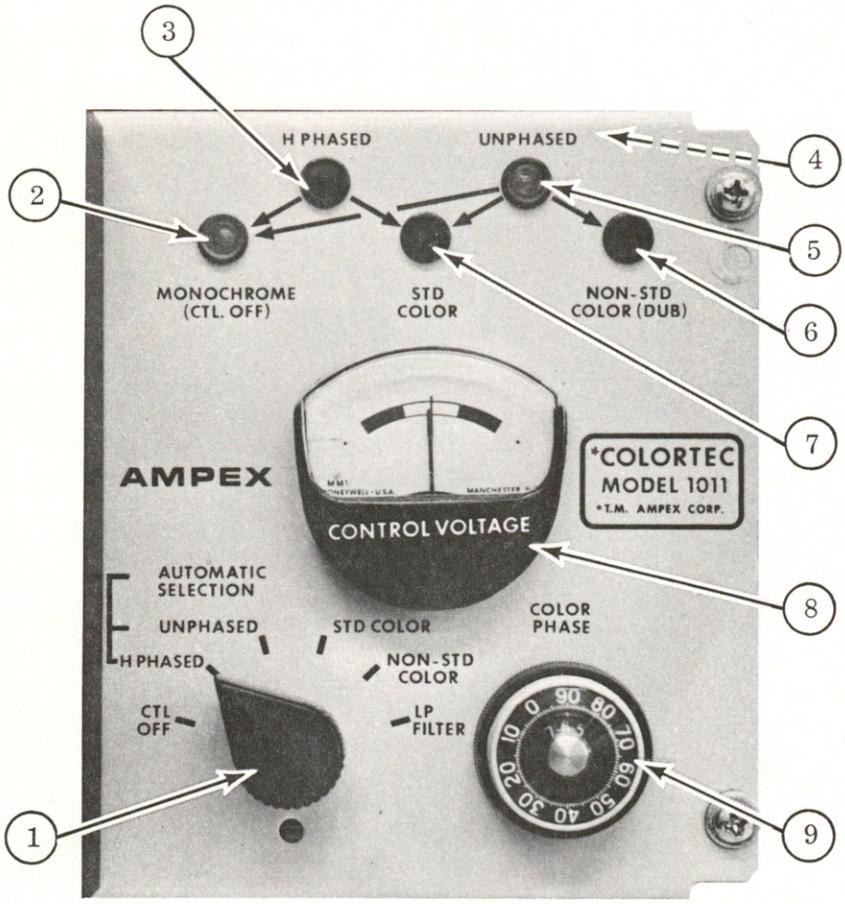
Figure 3-9. Amtec Controls and Indicators

Table 3-8. Amtec Accessory Operating Controls and Indicators

FIGURE 3-9 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1	Function selector	Six-position rotary switch. Allows selection of the mode of operation of the Amtec accessory
	EXT CTL position	External control is selected when time modulation of the video waveform with an external test signal is desired

Table 3-8. Amtec Accessory Operating Controls and Indicators (Continued)

FIGURE 3-9 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1 (Cont)	NOTE The required test signal is not provided by the VR-1200 recorder; a test signal may be connected to the Amtec accessory through connector J007S on the Amtec rear panel.	
	EXT REF (INTERSYNC) position	The external reference position is used in conjunction with the Intersync servo system during tape playback to obtain maximum time base stability and minimum head-drum phasing errors.
	CTL OFF position	Removes control voltage and converts the Amtec accessory to a video amplifier with fixed delay; the CTL OFF position is used when it is not required that the delay lines be modulated
	INT REF (AFC)	
	NORMAL position	Selects automatic mode in which the Amtec accessory selects one of three time constants that control the internal reference oscillator frequency rate-of-change
	FAST position	Selects the fast rate-of-change time constant. Used when there is a large low-frequency time-base error in the video signal
	REMOTE SELECT position	Enables the EXT REF or NORMAL position to be selected remotely. Setting the VR-1200B recorder SERVO MODE selector in the VERT, NORM, or PRESET positions selects the NORMAL mode of Amtec accessory operation; selecting AUTO or HORIZ on the SERVO MODE selector switches the Amtec accessory to EXT REF
2	EXT REF POSITION control	This variable capacitor is used to center the meter (item 3) when the Amtec function selector is in the EXT REF (INTERSYNC) position and the VR-1200B SERVO MODE selector is in the AUTO or HORIZ position
3	CONTROL VOLTAGE meter	This zero-center meter indicates a time comparison of reproduced sync with reference sync when the EXT REF POSITION control (item 2) is adjusted



1. Function Selector
2. MONOCHROME (CTL OFF) Indicator
3. H PHASED Indicator
4. REF BURST/TAPE BURST Switch
5. UNPHASED Indicator
6. NON-STD COLOR (DUB) Indicator
7. STD COLOR Indicator
8. CONTROL VOLTAGE Meter
9. COLOR PHASE Control

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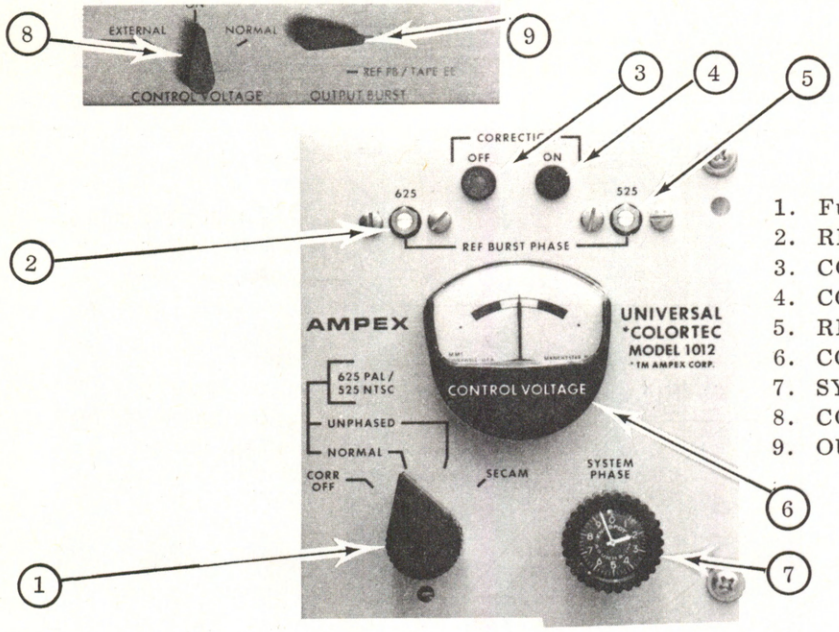
Figure 3-10. Colortec Controls and Indicators

Table 3-9. Colortec Accessory Operating Controls and Indicators

FIGURE 3-10 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1	Function selector	Six-position rotary switch. Allows selection of the Colortec accessory mode of operation
	CTL OFF position	Removes control voltage so that the Colortec accessory operates as a unity-gain amplifier; this is the normal position for monochrome signals
	AUTOMATIC SELECTION	
	H PHASED position	Selects an automatic mode in which the Colortec accessory is fully synchronized with reference sync and reference subcarrier. The mode appropriate for monochrome or standard NTSC color operation is automatically selected
	UNPHASED position	Selects an automatic mode in which the Colortec accessory operates unphased to the horizontal reference. The mode appropriate for monochrome, standard NTSC color, or non-standard color operation is automatically selected
	STD COLOR position	Selects a manual mode for reproduction of standard NTSC color signals; the system is not phased to the horizontal reference
	NON-STD COLOR position	Selects a manual mode for reproduction of non-standard color signals; the system is not phased to horizontal reference
	LP FILTER position	Removes control voltage and inserts a low-pass filter in the video signal path to remove the color subcarrier components and convert the signal to monochrome. Normally used when a non-standard color signal departs beyond the time-base correction capability of the Colortec accessory
2	MONOCHROME (CTL OFF) indicator	White indicator. Lights when a monochrome signal is being processed. Can occur in the CTL OFF, H PHASED, UNPHASED, or LP FILTER positions of the function selector

Table 3-9. Colortec Accessory Operating Controls and Indicators (Continued)

FIGURE 3-10 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
3	H PHASED indicator	Blue indicator. Lights when the Colortec accessory is operating fully synchronized with external reference sync and subcarrier. Will occur in the H PHASED or LP FILTER positions of the function selector
4	REF BURST/TAPE BURST switch (located on the test panel perpendicular to the control panel)	Toggle switch. Allows selection of color burst derived from tape during playback, or color burst from the external reference subcarrier. The burst selected will be routed to the processing amplifier
5	UNPHASED indicator	Amber indicator. Indicates that the Colortec accessory is not phase-locked to the horizontal reference. Will occur in the UNPHASED, STD COLOR, or NON-STD COLOR positions of the function selector
6	NON-STD COLOR (DUB) indicator	Red indicator. Lights when a non-standard color signal (rf dub from another video recorder) is being passed. May lights in the UNPHASED or NON-STD COLOR positions of the function selector
7	STD COLOR indicator	Green indicator. Lights when a standard NTSC color signal is being passed. May light in the H PHASED, UNPHASED, or STD COLOR positions of the function selector
8	CONTROL VOLTAGE meter	Zero-center indicator. Indicates average Colortec control voltage (detector output) when the recorder is in the playback mode. In the e-e or record modes, the meter indicates a fixed bias (input to the Colortec driver amplifier)
9	COLOR PHASE control	Ten-turn control. Provides for color phase adjustment of the composite video color output signal with regard to the external 3.58 MHz reference. Permits the phase of the reproduced color signal to be matched to the phase of any color signal source that is locked to the same reference
	NOTE The compression ring behind this control may be used to lock the control in place once the proper setting has been found.	



1. Function selector
2. REFerence BURST PHASE 625 adjustment
3. CORRECTION OFF indicator
4. CORRECTION ON indicator
5. REFerence BURST PHASE 525 adjustment
6. CONTROL VOLTAGE meter
7. SYSTEM PHASE control
8. CONTROL VOLTAGE selector
9. OUTPUT BURST selector

NOTE: Items 8 and 9 are located on the Test Points Panel

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Figure 3-11. Universal Colortec Controls and Indicators

Table 3-10. Universal Colortec Accessory Operating Controls and Indicators

FIGURE 3-11 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1	Function selector	Four-position rotary switch. Allows selection of Universal Colortec accessory mode of operation
	CORR OFF position	Correction off mode; Colortec control voltage is removed, and unit acts as a unity-gain amplifier
	625 PAL/525 NTSC	
	NORMAL position	Normal mode; Colortec circuits synchronize output signal with reference signals (subcarrier and sync)

Table 3-10. Universal Colortec Accessory Operating Controls and Indicators (Continued)

FIGURE 3-11 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1 (Cont)	UNPHASED position	Colortec locks to reference subcarrier without regard to horizontal sync excursions up to ±20 Usec. This position is to be used only for operation on non-standard NTSC signals. The SERVO MODE selector on the recorder main control panel must be set to HORIZ
	SECAM position	Enables recording or reproducing of SECAM color signals.
2	REFerence BURST PHASE 625 adjustment	Variable capacitor (screwdriver adjusted). Adjusts phase of 4.43 MHz reference burst (PAL)
3	CORRECTION OFF indicator	White indicator. Lights when the Colortec correction circuits are off
4	CORRECTION ON indicator	Green indicator. Lights when the Colortec correction circuits are on
5	REFerence BURST PHASE 525 adjustment	Variable capacitor (screwdriver adjusted). Adjusts phase of 3.58 MHz reference burst (NTSC)
6	CONTROL VOLTAGE meter	Zero-center indicator. Displays the output of the control voltage amplifier, indicating the direction and approximate amplitude of error
7	SYSTEM PHASE control	Ten-turn potentiometer. Sets color phase of output signal with respect to reference subcarrier. Used during fully synchronous operation to match color phase to external color signal sources.
	NOTE The compression ring behind this control may be used to lock the control once the proper setting has been found.	
8	CONTROL VOLTAGE selector	Three-position rotary switch. Allows selection of Colortec control voltage source as follows:
	EXTERNAL position	Allows application of external modulating voltage to correction circuits. This position is for test purposes only.

Table 3-10. Universal Colortec Accessory Operating Controls and Indicators (Continued)

FIGURE 3-11 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
8 (Cont)	CORRECTION ON position	Overrides Colortec function selector (item 1) so that control voltage is on at all times, whether signal has burst or not. This position is for test or marginal burst conditions only
	NORMAL position	Normal mode; Colortec correction circuits are activated by detecting the presence of color burst on the video signal, and automatically de-activated when monochrome signals are passed
9	OUTPUT BURST selector	Three-position rotary switch. Allows selection of output burst source during playback
	REF position	Recorder output signal burst is derived from reference subcarrier signal
	TAPE position	Recorder output signal burst is derived from the time-base-corrected video signal at the Colortec input
	REF PB/TAPE EE position	Recorder output signal burst is derived from the reference subcarrier signal in playback and from the incoming video signal in e-e

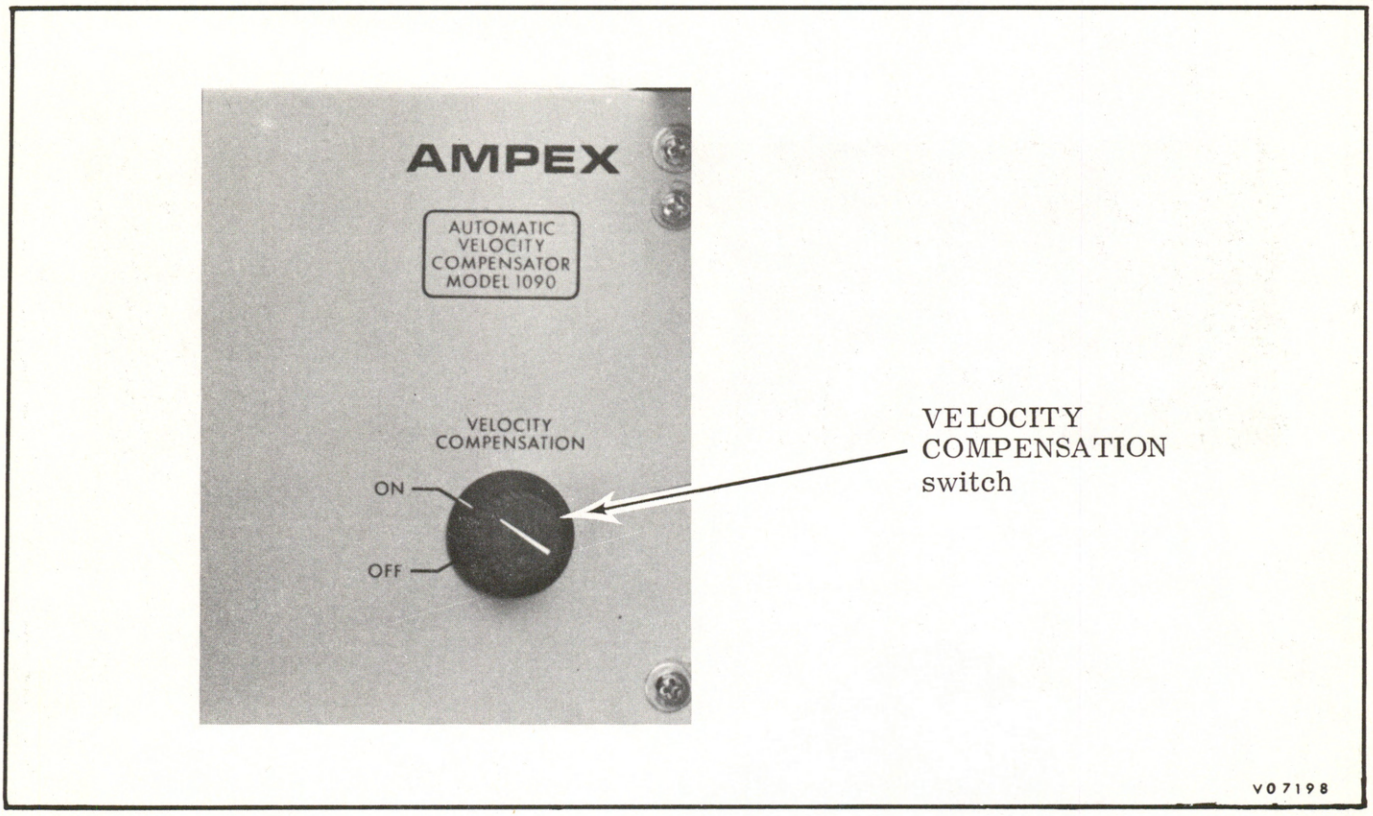
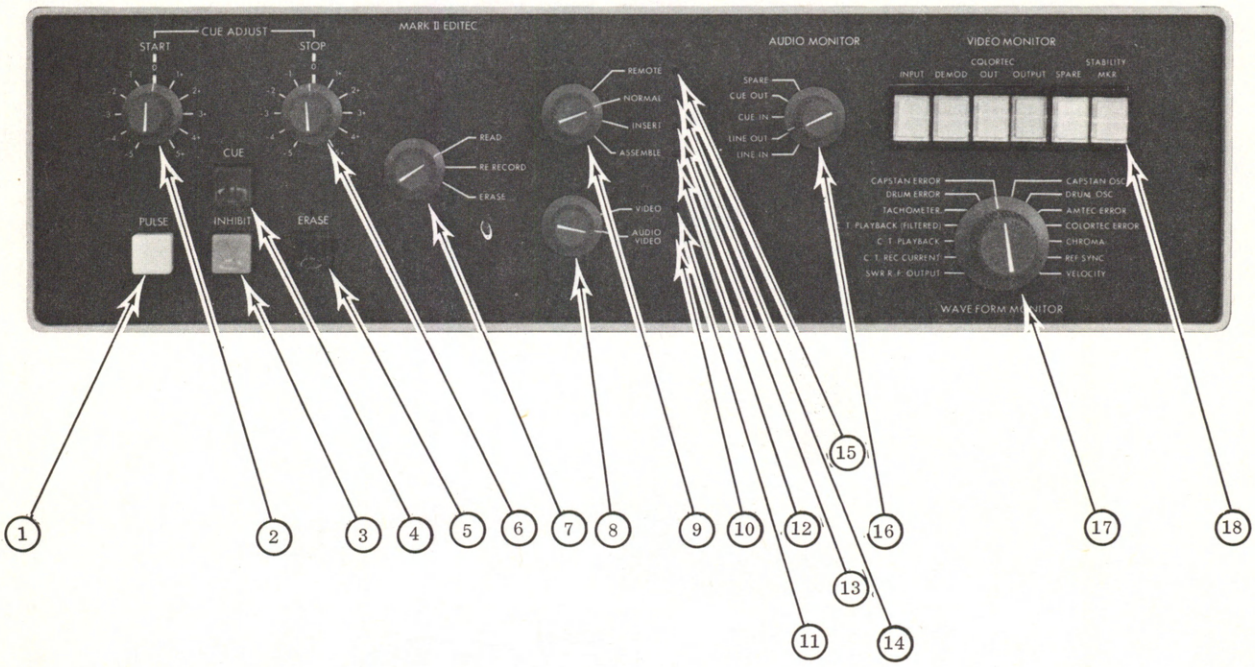


Figure 3-12. Automatic Velocity Compensator Controls and Indicators



1. PULSE switch and indicator
2. START CUE ADJUST control
3. INHIBIT switch and indicator
4. CUE switch and indicator
5. ERASE switch and indicator
6. STOP CUE ADJUST control
7. Editec mode selector

} MARK II EDITEC ACCESSORY

8. VIDEO/AUDIO-VIDEO selector
9. Editor mode selector
10. AUDIO-VIDEO indicator
11. VIDEO indicator
12. ASSEMBLE indicator
13. INSERT indicator
14. NORMAL indicator
15. REMOTE indicator

} MARK III ELECTRONIC EDITOR ACCESSORY

16. AUDIO MONITOR selector
17. WAVEFORM MONITOR selector
18. VIDEO MONITOR selector

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Figure 3-13. Monitor Switch Panel Controls and Indicators

Table 3-11. Monitor Switch Panel Operating Controls and Indicators

FIGURE 3-13 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1	PULSE switch and indicator (white illuminated push-button switch)	Editec control. When pressed, alternately generates start and stop pulses for the editor to simulate reproduced cues; may be used to program the editor in the absence of tape cues.
2	START CUE ADJUST control	Advances or delays start cue from normal position.
3	INHIBIT switch and indicator (orange illuminated pushbutton switch)	Editec control. When pressed, prevents generation of start and stop pulses to the editor; the lamp lights when the inhibit function is active (caused by pressing the pushbutton or by an unlocked servo).
4	CUE switch and indicator (green illuminated push-button switch)	Editec control. When pressed, causes a single tone burst to be recorded, regardless of the position of the mode selector; the lamp flashes each time a cue is reproduced from tape or when the PULSE pushbutton is pressed.
5	ERASE switch and indicator (red illuminated push-button switch)	Editec control. When pressed, causes erasure of pre-recorded cues; the lamp lights when the pushbutton is pressed in read mode, and lights continuously when editec is in re-record or erase mode and the recorder is in play or record mode.
6	STOP CUE ADJUST control	Advances or delays stop cue from normal position.
7	Editec mode selector	Selects program unit mode of operation.
	READ position	In read mode reproduced cues alternately generate start and stop pulses for the editor.
	RE-RECORD position	In re-record mode pre-recorded cues are erased and new cues are recorded. The new cues are shifted in time as a function of the CUE ADJUST controls. Start and stop pulses for the editor are also generated.

Table 3-11. Monitor Switch Panel Operating Controls and Indicators (Continued)

FIGURE 3-13 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
7 (Cont)	ERASE position	In erase mode pre-recorded cues are erased; start and stop pulses are not generated.
8	VIDEO/AUDIO-VIDEO selector switch	Electronic Editor control. Selects the option of recording both audio and video, or video only.
9	Editor mode selector switch	Electronic Editor control. Selects one of the following modes of operation.
	REMOTE	Enables editor mode to be selected by remote editor control panel.
	NORMAL	Removes editor from the circuit.
	INSERT	Sets up editor for making insert into pre-recorded material.
	ASSEMBLE	Sets up editor to assemble a tape.
10	AUDIO-VIDEO indicator	Electronic Editor indicator. Lights when option of recording both audio and video is selected.
11	VIDEO indicator	Electronic Editor indicator. Lights when option of recording only video is selected.
12	ASSEMBLE indicator	Electronic Editor indicator. Lights when editor assemble mode is selected.
13	INSERT indicator	Electronic Editor indicator. Lights when editor insert mode is selected.
14	NORMAL indicator	Electronic Editor indicator. Lights when system is operating with editor out of the circuit.
15	REMOTE indicator	Electronic Editor indicator. Lights when editor is under remote control.
16	AUDIO monitor selector switch	Selects one of the following audio signals to be monitored.
	LINE IN	Selects audio line input.

Table 3-11. Monitor Switch Panel Operating Controls and Indicators (Continued)

FIGURE 3-13 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
16 (Cont)	LINE OUT	Selects audio line output (tape playback).
	CUE IN	Selects cue channel input.
	CUE OUT	Selects cue channel output (tape playback).
	SPARE	Selects spare audio channel.
17	WAVEFORM MONITOR selector	Selects one of the following to be displayed on the waveform monitor:
	SWR. R.F. OUTPUT	Combined detected rf output of all four head channels from the signal system (module 6)
	C.T. REC. CURRENT	Control track record current
	C.T. PLAYBACK	Control track playback output
	C.T. PLAYBACK (FILTERED)	Filtered control track playback output
	TACHOMETER	Head drum tachometer output
	DRUM ERROR	Rotary head drum position error signal
	CAPSTAN ERROR	Intersync capstan speed error signal
	CAPSTAN OSC	Output of the Intersync capstan oscillator
	DRUM OSC	Output of the Intersync head drum oscillator
	AMTEC ERROR	Amtec error signal
	COLORTEC ERROR	Colortec error signal
	CHROMA	Chroma display from the Audio-chroma accessory
	REF SYNC	Reference sync from Intersync servo system
	VELOCITY	Velocity Compensator error signal
18	VIDEO MONITORS SELECTORS and indicators (set of six illuminated push-buttons)	Select one of the following signals to be displayed on the video monitor.

Table 3-11. Monitor Switch Panel Operating Controls and Indicators (Continued)

FIGURE 3-13 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
18 (Cont)	INPUT	Signal system modulator input
	DEMOD	Signal system output video module output
	COLORTEC OUT	Colortec accessory output
	OUTPUT	Processing amplifier output
	SPARE	Optional spare input
	STABILITY MKR	Processing amplifier output with stability dots superimposed

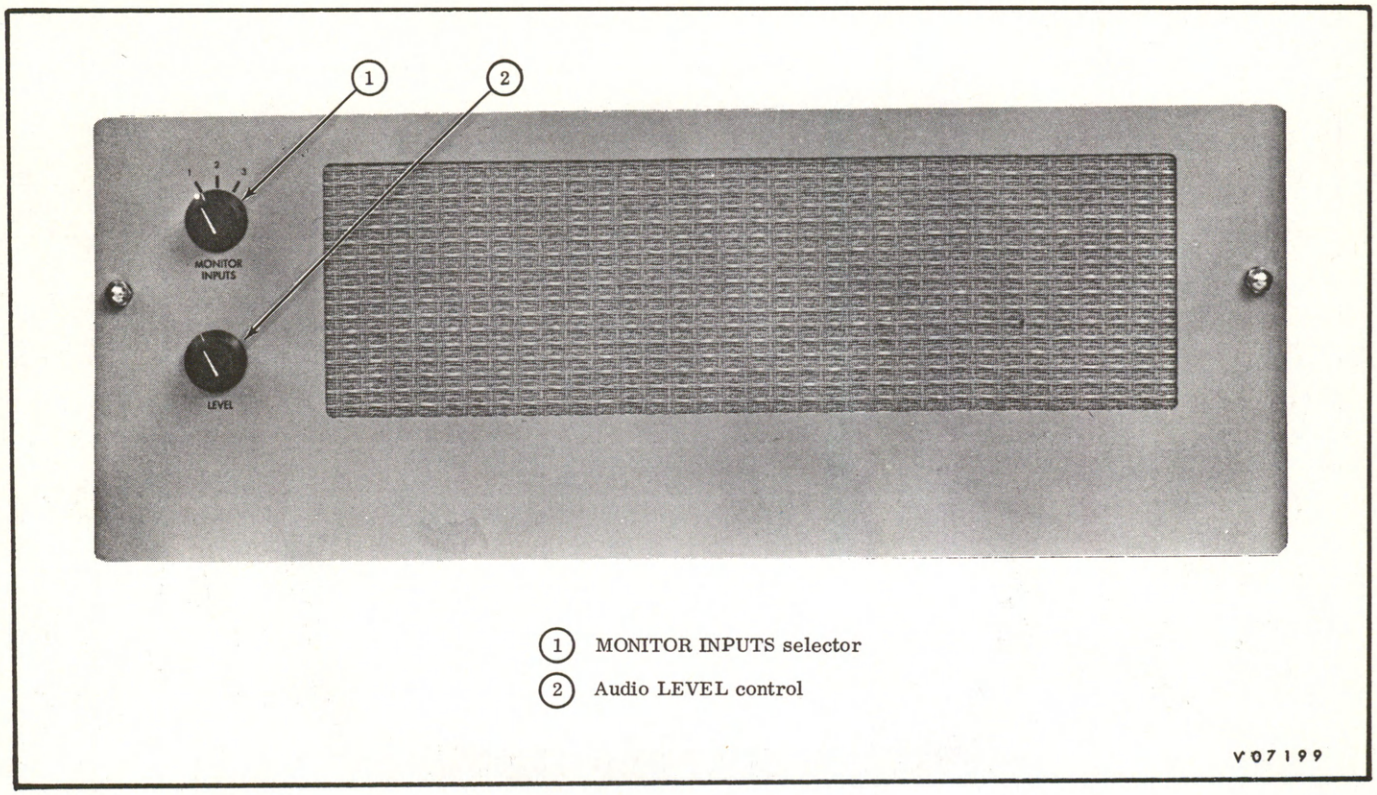
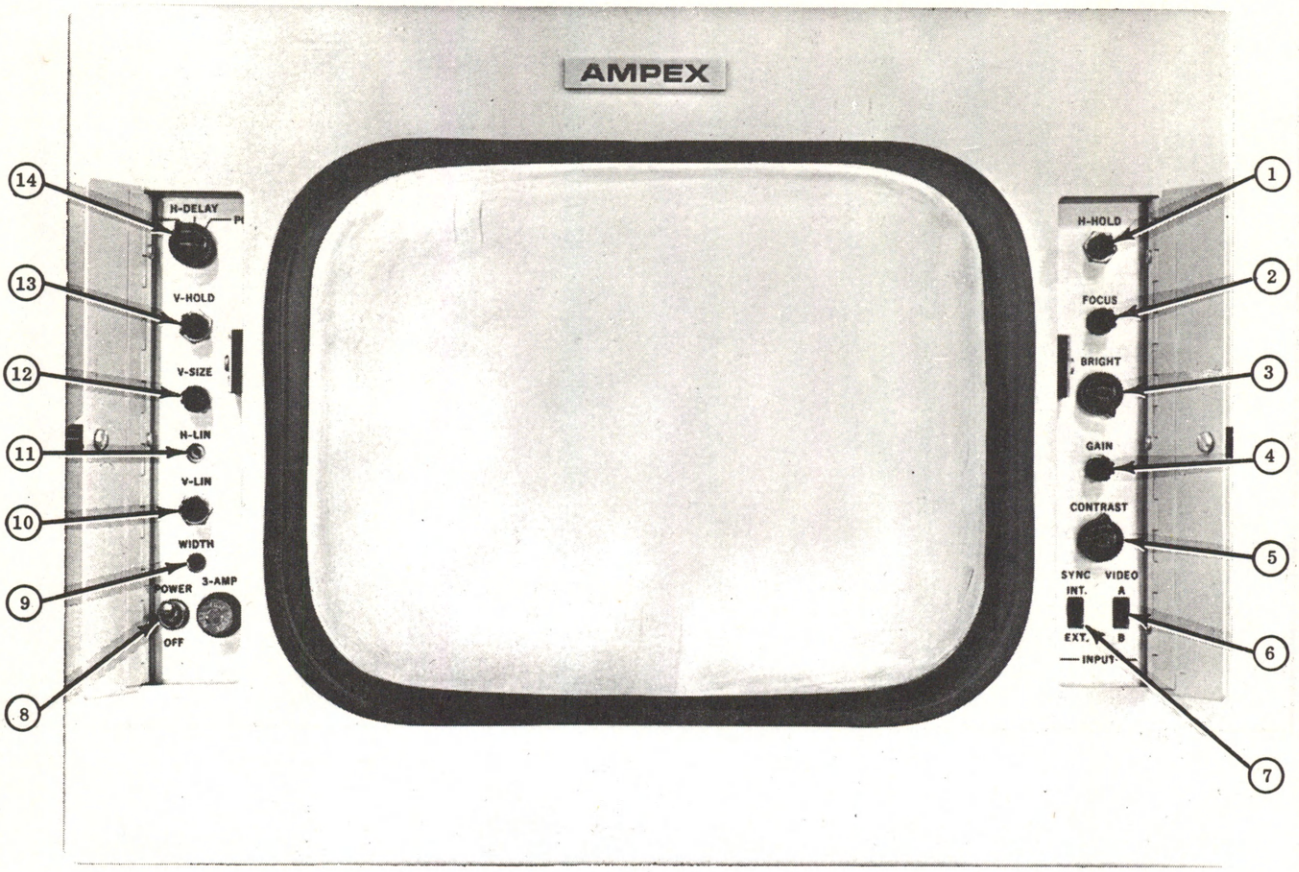


Figure 3-14. Audio Monitor Controls and Indicators

Table 3-12. Audio Monitor Operating Controls and Indicators

FIGURE 3-14 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1	MONITOR INPUTS selector switch	Selects one of the following inputs to audio monitor:
	1	Audio input selected at monitor switch panel (this is normal switch setting)
	2	Cue channel input
	3	Auxiliary channel input
2	LEVEL control	Adjusts level of audio signal.



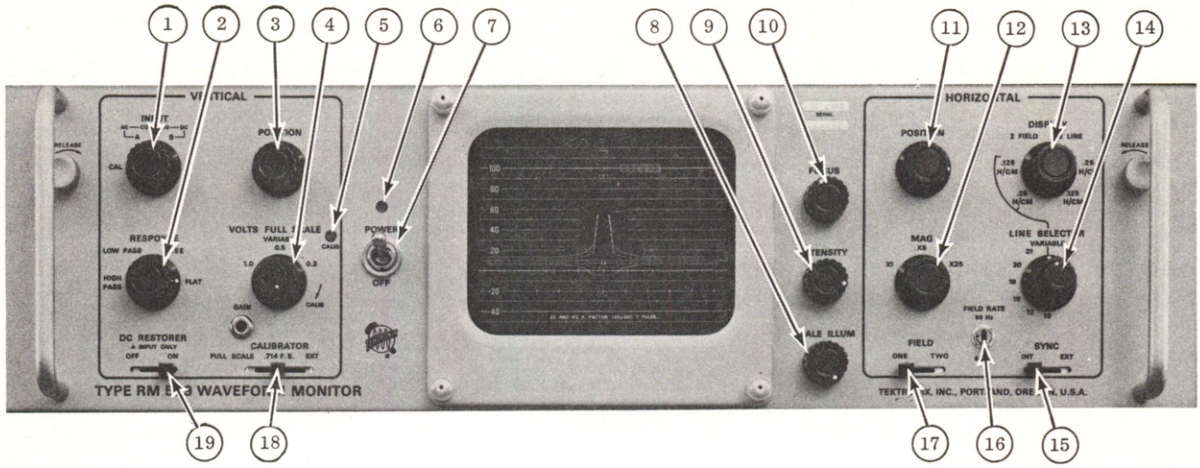
1 Horizontal-Hold control
2 FOCUS control
3 BRIGHTness control
4 GAIN control
5 CONTRAST control
6 VIDEO input selector
7 SYNC selector
8 POWER switch
9 WIDTH adjustment
10 Vertical-LINearity control
11 Horizontal-LINearity adjustment
12 Vertical-SIZE control
13 Vertical-HOLD control
14 Display selector

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Figure 3-15. Video Monitor Controls and Indicators

Table 3-13. Video Monitor Operating Controls and Indicators

FIGURE 3-15 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1	Horizontal Hold control	Adjusts operating point of horizontal AFC circuit to eliminate horizontal bending or tearing.
2	FOCUS control	Adjusts picture tube focusing anode potential.
3	BRIGHTness control	Adjusts picture tube control grid potential.
4	GAIN control	Adjusts gain of video signal
5	CONTRAST control	Adjusts black/white ratio of picture.
6	VIDEO input selector	Selects one of two video input sources.
7	SYNC selector	Selects internal or external sync source.
8	POWER switch	Applies primary power to video monitor.
9	WIDTH control	Adjusts width of picture.
10	VERTical LINearity control	Adjusts linearity of vertical amplifier to eliminate compression at top of picture.
11	HORIZontal LINearity adjustment	Adjusts horizontal linearity of picture.
12	Vertical SIZE control	Adjusts height of picture.
13	Vertical HOLD control	Adjusts operating point of vertical oscillator to eliminate roll or jitter.
14	Display selector	Selects one of following displays:
	N	Normal picture
	H DELAY	Picture displaced horizontally
	PC	Picture displaced horizontally and vertically (pulse-cross display).



1. INPUT Selector
2. RESPONSE Selector
3. Vertical POSITION Control
4. Vertical Sensitivity Control
5. Vertical Sensitivity CALIBration Indicator
6. POWER Indicator
7. POWER Switch
8. SCALE ILLUMination Control
9. INTENSITY Control
10. FOCUS Control
11. Horizontal POSITION Control
12. Sweep MAGnification Selector
13. DISPLAY Selector
14. LINE SELECTOR
15. SYNC Selector
16. FIELD RATE Selector
17. FIELD Selector
18. CALIBRATOR Selector
19. DC RESTORER Control

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Figure 3-16. Waveform Monitor Controls and Indicators

Table 3-14. Waveform Monitor Operating Controls and Indicators

FIGURE 3-16 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
1	INPUT selector	Selects input from the WAVEFORM MONITOR selector (B), the VIDEO MONITOR selector (A), or the internal calibrator.
2	RESPONSE selector	Selects HIGH PASS, LOW PASS, IEEE, or FLAT response.
3	Vertical POSITION control	Sets bias on crt vertical deflection plates.
4	VOLTS FULL SCALE selector	Permits selection of calibrated vertical gain of 1.0, 0.5, 0.2, or variable vertical gain.
5	Vertical sensitivity CALIBration indicator	Lights when the variable gain control is out of the circuit.
6	POWER indicator	Lights when the power is on.
7	POWER switch	Turns power on

Table 3-14 Waveform Monitor Operating Controls and Indicators (Continued)

FIGURE 3-16 INDEX NO.	CONTROL OR INDICATOR	FUNCTION
8	SCALE ILLUMination	Sets voltage of scale lamps.
9	INTENSITY control	Controls display brightness.
10	FOCUS control	Sets operating point of crt focus anode.
11	Horizontal POSITION control	Sets bias on crt horizontal deflection plates.
12	Sweep MAGnification selector	Multiplies sweep speed by a factor of 1, 5, or 25.
13	DISPLAY selector	Selects sweep speed.
14	LINE SELECTOR	Used in conjunction with the DISPLAY selector to start the sweep on any selected line in a field.
15	SYNC selector	Selects internal sync or sync from an external source.
16	FIELD RATE selector	Adjusts sweep speed for 50 or 60 Hz field rate (25 or 30 Hz frame rate).
17	FIELD selector	Selects the first or the second field in a frame of video when the DISPLAY selector is in the 2 FIELD position.
18	CALIBRATOR selector	When INPUT selector is in the CAL position, selects internal calibration voltage of full scale value (140 IEEE units), 0.714 full scale value (100 IEEE units), or calibration voltage from external source (if such voltage has been provided).
19	DC RESTORER control	Enables the dc restoration circuitry which stabilizes the back porch at a constant level on the crt (active only when the A input has been selected by the input selector).

3-35 PRE-OPERATIONAL PROCEDURES

3-36 Operating instructions for the VR-1200B videotape recorder are divided as follows:

a. Familiarization Checks (paragraph 3-37). The purpose of this procedure is to acquaint a new user with the recorder, and to ensure that the recorder has sustained no damage during shipping. Both playback and record familiarization and checkout are included.

b. Pre-operational checks (paragraph 3-41). Prior to actual operation of the recorder, certain checks should be made to ensure that the system is operating satisfactorily and that all adjustable controls have been set to the optimum point; the necessary information is contained in these procedures.

3-37 Familiarization Checks

3-38 PLAYBACK CHECK. After the recorder has been installed, and the user has become familiar with the location and function of each chassis and control, the following procedures should be performed. In addition to the function of familiarizing the user with the operation of the recorder, the successful completion of this procedure indicates that the recorder is operating properly. (Note that two of the steps require the user to have an assistant.) These procedures do not have to be repeated before each use of the VR-1200B recorder.

a. Ensure that a composite video signal is connected to the VIDEO IN connector of the external connector panel, and that the format of the video signal is within the specifications described in Section I of this manual.

b. Ensure that a sync reference signal is connected to the SYNC IN connector of the external connector panel. The sync signal must be within the limits described in Section I of this manual.

c. For color operation, ensure that a horizontal drive signal is connected to the H DRIVE IN connector, and that a subcarrier signal is connected to the SUBCARRIER IN connector of the external connector panel. Check the levels of the signals.

d. For operation of 625-line color standards, ensure that the recorder is supplied with a 7.8 kilohertz reference signal.

NOTE

The sync reference signal, the horizontal drive signal, the subcarrier signal, and the 7.8 kilohertz reference signal must be from a common signal source (usually the station sync generator).

e. Ensure that program audio and cue lines are connected to the appropriate connectors of the external connector panel.

NOTE

Depending on system requirements, the VIDEO OUT, NON-COMPOSITE VIDEO OUT, SYNC OUT, REMOTE CONTROL, and audio input and output connections should be checked. Ensure that the signal sources and loads are compatible with the requirements of the VR-1200B recorder as described in Section I of this manual.

f. If it has not already been done, connect the power cable of the recorder to an adequate power source. Ensure that the power source is compatible with the system requirements described in Section I of this manual. Ensure that the air bearing system compressor power cable is connected to the air compressor connector (J5) on the power distribution panel.

g. Pull out circuit breaker CB11, marked SERVO 135V SUP on the system power supply front panel; this will disable the head drum power supply in the Intersync servo system and ensure that the head drum does not rotate until the air bearing system has been checked.

h. Place the main POWER circuit breaker in the ON position and immediately observe the status of the READY switch; if it is lighted, press the switch and be sure the light goes out; the air bearing system compressor should start.

NOTE

The air compressor may be in a remote location making it difficult to determine that the compressor has started. Proper air bearing system operation will be checked in a later step.

i. Turn the power switches on all chassis to the on positions. Check all fuseholders to ensure that none are lighted (a lighted fuseholder indicates a missing or blown fuse). Check all circuit breakers to make sure none have tripped (the breaker will be extended and show a white ring).

j. Lift the rotary head cover to expose the rotary head assembly and set the PLAY/REC lever to the neutral position (perpendicular to the transport). Set the automatic guide servo switch to the MAN mode to disable the automatic circuits.

k. Disable the end-of-tape circuits by holding one of the supply reel compliance arm in the outward position. Simultaneously press the warning lamp test switch (located directly under the group of warning indicators) to ensure that all warning indicator lamps are operational.

l. Observe all cooling fans to ensure proper operation (the head blower will not be on at this time).

m. Check the operation of the vacuum pump by observing the vacuum meter at the rear of the recorder; the meter will register only about 10 in. H2O because tape is not in the vacuum guide, however, a complete check of the vacuum system will be made in a later step.

n. Observe the air bearing system pressure gage and ensure that the gage indicates 55 (±2) psi. The pressure will take approximately 1 minute to reach 55 psi after power is applied.

NOTE

Bearing air pressure is set at the factory, however it is dependent upon barometric pressure (i.e., altitude above sea level) at the operating site. If the pressure is not within the specified limits, perform the procedures described in Section VIII for air bearing pressure adjustment.

o. Reach into the video head assembly above the vacuum tape guide and lightly spin the head drum; if proper air bearing pressure is present, the head drum will spin easily. Without bearing air, the head drum will not move.

p. Reset the SERVO 135V SUP breaker pulled in step g.

q. Place the recorder in the ready mode by pressing the READY button. Check that the head blower starts, the head drum and capstan rotate, and the READY button lights.

CAUTION

IN THE FOLLOWING STEP, IF THE HEAD DRUM CONTINUES TO ROTATE NORMALLY AND HEAD DRUM POWER IS NOT INTERRUPTED BY THE TIME BEARING AIR DECREASES TO 30 PSI. SET THE SYSTEM POWER CIRCUIT BREAKER TO OFF. IF THE HEAD DRUM IS ALLOWED TO ROTATE WITHOUT BEARING AIR, THE VIDEO HEAD ASSEMBLY WILL BE DAMAGED.

r. Have an assistant remove the compressor power cable from the power connector (J5) and check that the BEARING AIR warning indicator lights when system air decreases to 50 (±2) psq. Check that the head drum stops rotating when the system air decreases to 40 (±2) psi.

s. Have the assistant connect the compressor power cable to the power connector (J5) and check that the head drum starts when system air pressure reaches 40 (±2) psi and that the BEARING AIR warning indicator remains lighted until the pressure reaches 50 (±2) psi.

t. Again press the READY button to stop the head drum rotation.

u. Place a roll of scrap tape on the supply reel hub and thread the tape through the tape path as follows (see Figure 3-17).

CAUTION

TO PREVENT DAMAGE TO THE VIDEO HEAD ASSEMBLY AND THE TAPE, THE HEAD DRUM MUST NEVER BE ACTIVATED DURING THE TAPE-THREADING PROCEDURE. IN ADDITION, THE HEAD DRUM SHOULD BE COMPLETELY STOPPED (EXCEPT IN AN EMERGENCY) BEFORE THE MAIN POWER CIRCUIT BREAKER IS SET TO OFF.

1. Orient the roll of tape on the supply reel so that the tape emerges from the left side of the reel. fasten the reel to the turntable by rotating the holddown knob clockwise until the locking pawls securely engage the top surface of the reel.

2. Place the empty reel 28050 supplied with the recorder on the takeup turntable and secure it in a similar manner.

3. Hold the supply compliance arm fully to the left and withdraw 6 to 8 feet of tape from the reel.

NOTE

Holding the compliance arm to the left disables the reel brakes; if the recorder is equipped with a foot brake release switch, it will accomplish the same function.

NOTE

During the tape-threading procedure, the vacuum guide should remain latched in place. This ensures that the tape will make the proper contact with the video heads and the control track head (mounted on the video head assembly).

4. Route the tape to the right of the supply compliance arm pin, through the supply idler and erase head assembly, through the vacuum guide, (Insert the edge of the tape into the space between the head drum and the vacuum guide), between the audio head assembly and guide, between the capstan and capstan idler, around the tape counter idler, to the left of the take-up compliance arm pin and counterclockwise around the take-up reel. Hold the tape to the reel hub and wind several layers of tape on the reel until it is securely fastened to the reel.

5. Ensure that the tape is properly positioned on the tape guides and that the lower edge of the tape is seated against the shoulder of the lower edge of the vacuum guide.

6. Turn the take-up reel counterclockwise until all slack is removed and both compliance arms are away from the rest positions.

CAUTION

DO NOT OPERATE THE RECORDER FOR ANY EXTENDED PERIOD WITHOUT ROTARY HEAD COOLING AIR. EXCESSIVE HEAT MAY DAMAGE THE ROTARY HEAD ASSEMBLY.

v. Press the READY button and observe that the COOLING AIR warning indicator will light for approximately one second and go out.

w. Observe the vacuum system gage and check for an operating vacuum of 40 (±2) in. H2O. Observe that the GUIDE VACUUM warning indicator and the REC LOCK OUT indicator are lighted when vacuum is less than 30 (±2) in. H2O. The GUIDE VACUUM

indicator will also light should the vacuum be greater than 50 in. H2O. Guide vacuum is set at the factory, however it is dependent upon barometric pressure (i.e., altitude above sea level) at the operating site. If the guide vacuum is not within the specified limits, perform the guide vacuum adjustment procedure described in Section VIII.

NOTE

Insufficient vacuum will activate the record-lock-out interlock and prevent the system from operating in the record mode. Should vacuum be lost during a recording operation, the system will continue to operate until the stop mode is initiated. Insufficient vacuum will not prevent the system from operating in the play mode. This feature permits a program to continue should vacuum be lost; the operator can eliminate most picture distortions through manual adjustments of guide height and head tip projection.

x. Press the FAST FWD pushbutton to verify fast-forward operation; allow the tape to reach shuttling speed, and press the STOP pushbutton.

y. Check the rewind mode by pressing the RWD pushbutton. Allow the tape motion to reach shuttling speed, and press the STOP pushbutton.

z. Check the transport interlock by placing the transport in the fastforward mode and then pressing the PLAY pushbutton. The transport should continue in the fast-forward mode.

aa. Similtaneously press the STOP and PLAY pushbuttons, then release the STOP pushbutton. The system will not enter the play mode until the tape has completely stopped. The PLAY pushbutton must be held until the tape motion has stopped.

ab. Press the STOP pushbutton.

ac. Rewind the tape onto the supply reel, then remove the reel from the recorder.

ad. Place the head alignment tape supplied with the recorder on the supply reel, then thread the tape on the transport (see Figure 3-17).

ae. Ensure that the tape SPEED selector has selected the 15 inches-per-second (ips) tape speed, and prepare the system for playback operation as follows:

1. Set the signal system video standards selector to the proper standards position.

2. Set the SERVO MODE selector (main control panel) to the NORM position. Set the following controls on the Intersync chassis to the positions indicated:

 (a) NON-STANDARD TRACKING control to NORMAL

 (b) TAPE SPEED OVERRIDE control selector to NOR

3. Turn the four PLAYBACK EQUALIZATION controls and the MASTER EQUALIZER control of the signal system to the midrange positions.

4. Set the VIDEO GAIN control of the output video module to the UNITY position.

5. If the system is equipped with an Amtec time element compensator, set the Amtec function selector to the CTL OFF position.

6. If the system is equipped with a Colortec or Universal Colortec accessory set the Colortec function selector to the CTL OFF position.

7. If the system is equipped with an Automatic Velocity Compensator accessory, set the VELOCITY COMPENSATION switch to OFF.

8. Set the processing amplifier VIDEO CONTROLS selector to the UNITY position. If the system is equipped with

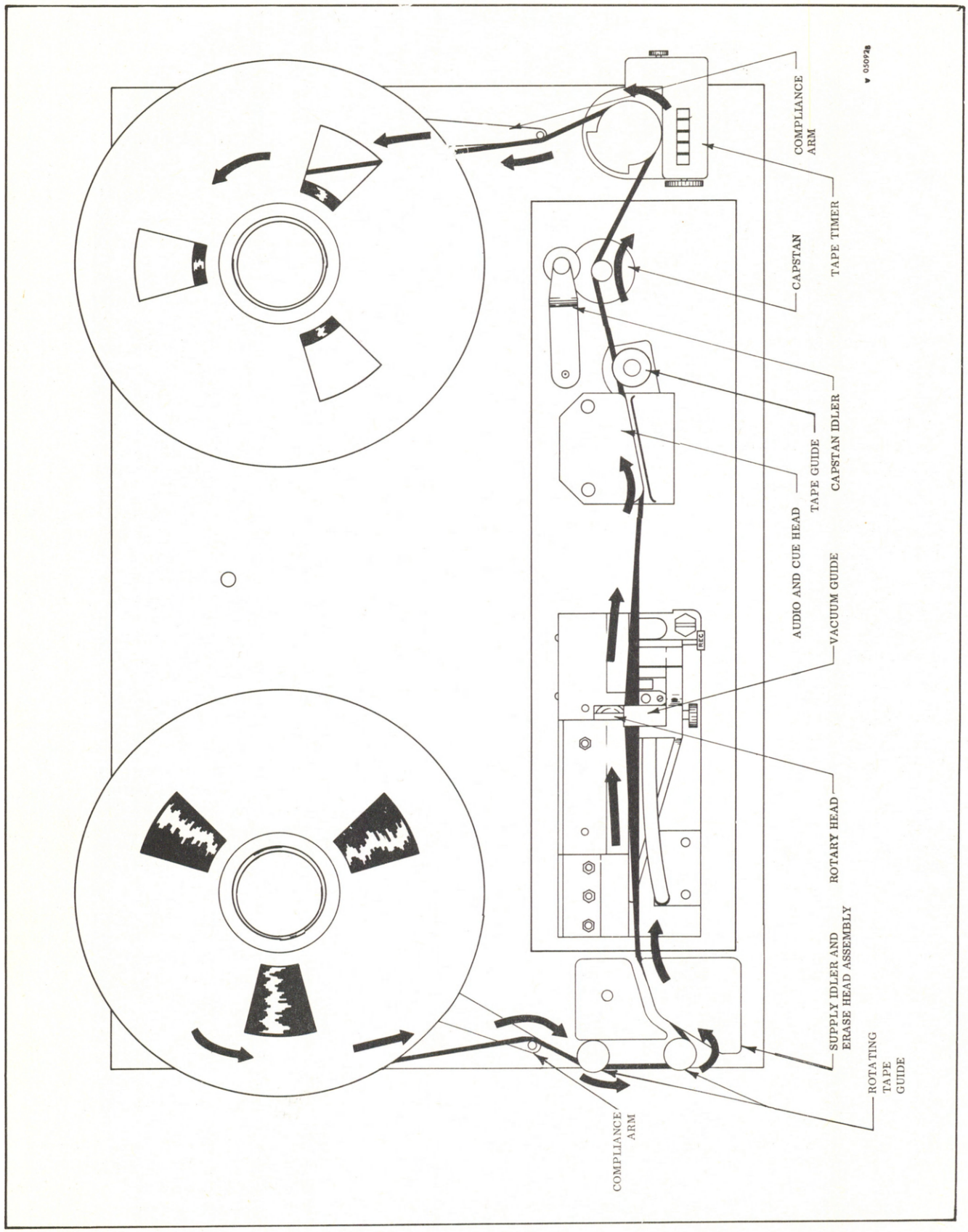


Figure 3-17. Tape Threading Path

an Amtec time element compensator, set the processing amplifier SYNC switch to the RE GEN or EXT REF position. If the system is not equipped with an Amtec accessory, set the SYNC switch to the GATED position.

9. Set the TRACK SELECTOR to the HOME-TRACK position.

af. Press the VIDEO MONITOR INPUT switch located on the monitor switching panel. Observe the image of the input composite video signal on the video monitor.

NOTE

Ensure that the record amplifier MOD/RF DUB selector (signal system record amplifier module) is set to the MOD position.

ag. Place the recorder in the electronics-to-electronics (e-e) mode by pressing the EE-TAPE switch. (The EE-TAPE switch lights to indicate that the recorder is in the tape playback mode; the switch does not light when the e-e circuits are in operation.)

ah. Press the VIDEO MONITOR DEMOD switch and observe the video monitor. The quality of the image displayed on the monitor must closely resemble the input signal observed in step af.

NOTE

This procedure routes the composite signal through the video signal system and by-passes the video heads and the tape.

ai. Set the REC/PLAY lever on the video head assembly to PLAY.

NOTE

A tape which has been recorded with the head assembly REC/PLAY lever in the REC (standard head-tip penetration) position may be played back with the lever in the REC position. However, in this position it will not be possible to correct vacuum guide position errors with the automatic guide servo.

aj. Place the system in the play mode by pressing the PLAY button. The system will automatically disable the e-e circuits and the video monitor will display the prerecorded reference signal.

ak. Adjust the TRACKING control for a maximum indication on the TRACKINGREC CURRENT meter.

al. Ensure that the automatic guide servo is in the MAN mode and adjust the TIP PROJ control to eliminate any picture skewing displayed on the monitor (see Figure 3-18).

am. Adjust the vacuum guide height to eliminate any picture scalloping (see Figure 3-19).

an. If the system is equipped with an Amtec time element compensator, set the Amtec function selector to the REMOTE SELECT position. Make sure that the VERT and HORIZ LOCK on the VR-1200B main control panel indicators are lighted.

NOTE

If the recorder is equipped with a differential gain channel amplifier adjust signal system module 6 to minimize differential gain; refer to the operating procedures in kit manual 1809001.

ap. Adjust the MASTER EQUALIZATION controls for overall flat frequency response, and elimination of head banding on the video monitor. Observe the effect of interaction between these controls and the differential gain controls on the channel amplifiers.

NOTE

If the recorder is equipped with an Auto-chroma accessory, this procedure is modified. Refer to Auto-chroma manual 1809973.

aq. This completes familiarization and checkout procedures for playback operation. Should any malfunctions or discrepancies occur during this procedure, refer to Section VIII of this manual for maintenance procedures.

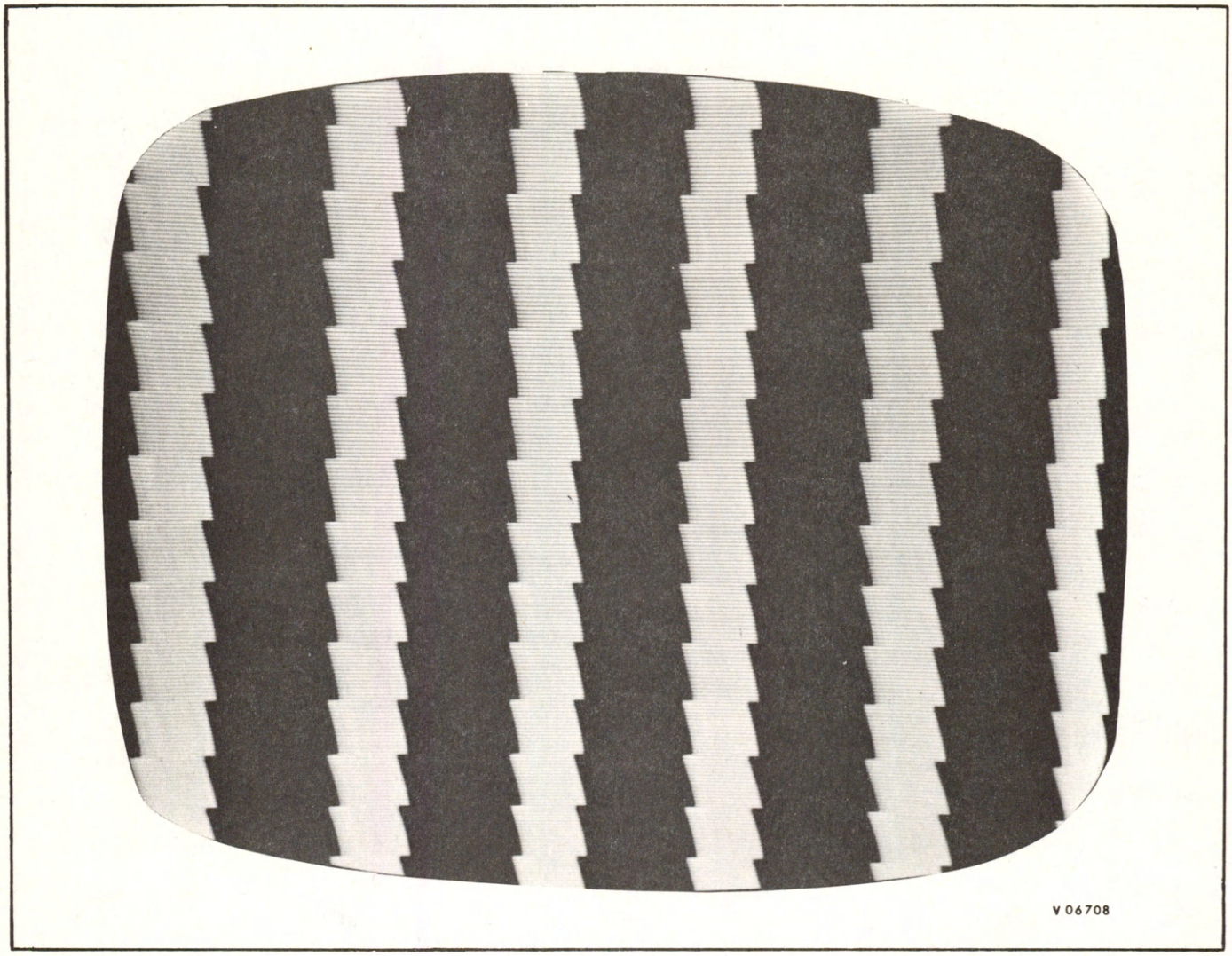


Figure 3-18. Picture Skewing of Vertical Bar Test Signal

3-39 RECORD CHECK. The familiarization and checkout procedures for record operation are as follows:

a. Rewind the reference tape on the supply reel and remove the reel from the transport. Place a roll of degaussed tape on the supply reel and thread it through the tape path as described in step u.

b. Set the video head assembly REC/PLAY lever to REC.

NOTE

If the signal system is equipped with the afc accessory, ignore steps c through e.

c. Set the video signal system standards selector to the 525 COLOR position and rotate the modulator VIDEO GAIN control fully counterclockwise.

d. Using a calibrated oscilloscope, frequency meter, frequency counter, or other suitable means (e.g. an accurately calibrated receiver) check the frequency of the modulator carrier oscillator. The frequency of the carrier at the RF test point on the record amplifier module should be 5.6 MHz.

NOTE

The 525 COLOR standard is selected because this standard is most crit-

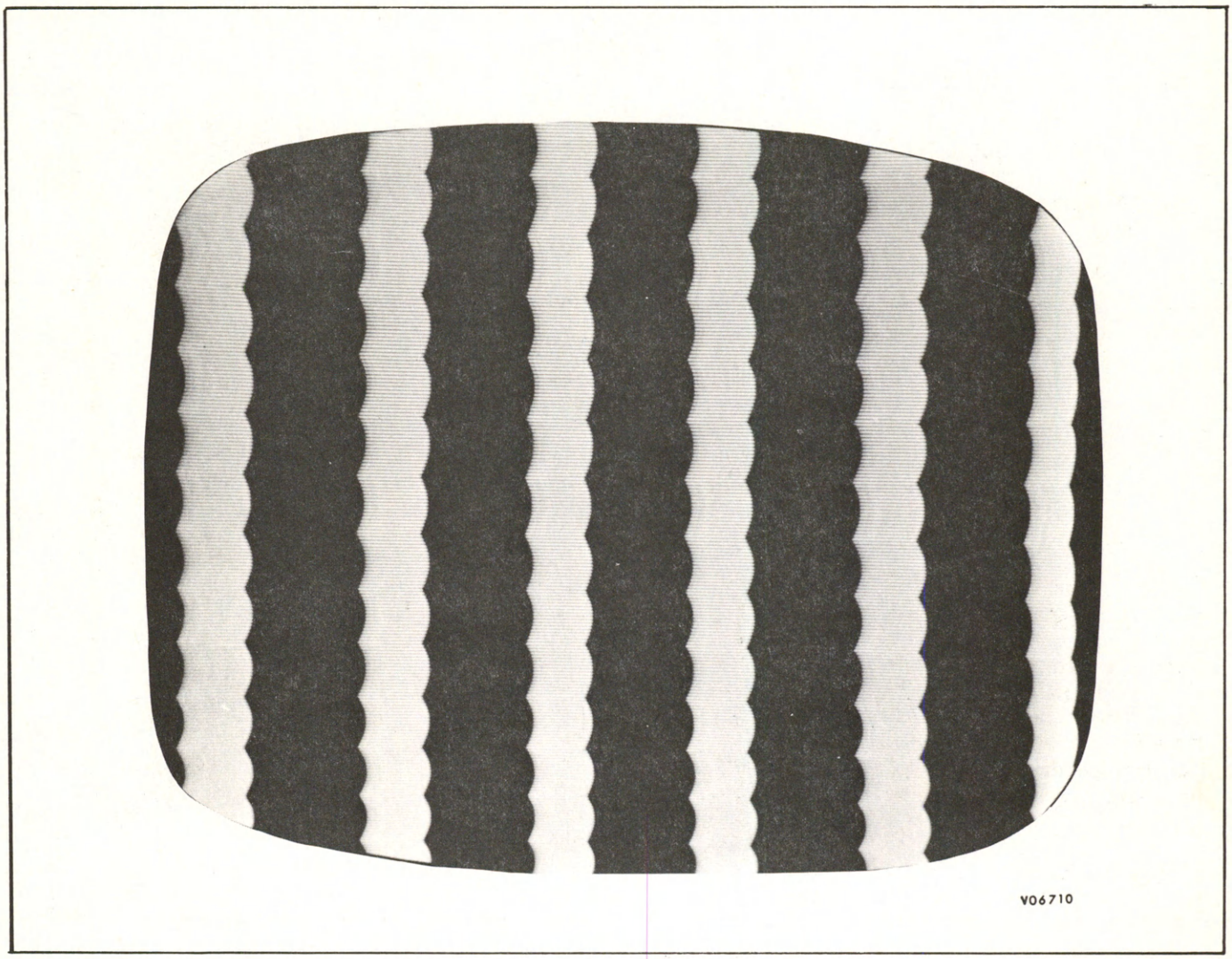


Figure 3-19. Picture Scalloping of Vertical Bar Test Signal

ical of carrier frequency. With the modulator properly adjusted in this standard will be within tolerance. Setting the carrier oscillator at 5.6 MHz without a video signal will result in a sync tip frequency of 5.5 MHz with a video signal. Refer to Section VIII of this manual for detailed description of procedures used to set the carrier frequency.

e. Connect a 1V p-p multiburst video signal to the VIDEO IN connector on the external connector panel.

f. Set the video standards selector to the proper standards position.

g. Set the VIDEO GAIN control of the signal system output video module to the UNITY position.

h. Observe the output of the output video module (set the waveform monitor INPUT selector to A and press the VIDEO MONITOR DEMOD switch).

i. Adjust the VIDEO GAIN control of the modulator to obtain a 1V p-p signal. If the level of the multiburst signal is 1V p-p, the modulator VIDEO GAIN control should be at the UNITY position.

j. Set the servo mode selector to the NORM position.

NOTE

The following steps describe the setting of optimum record current using the optional waveform monitor. The TRACKING meter may be used instead.

k. Observe the output of the channel amplifier module (waveform monitor INPUT selector to B, WAVEFORM MONITOR selector to SWR. R.F. OUTPUT).

NOTE

If the system is equipped with an optional video head optimizer, ignore steps l through q and perform steps r through y.

l. Place the system in the record mode by simultaneously pressing the PLAY and RECORD buttons. Set the RECORD current selector to the channel 1 position. Rotate the CH1 RECORD LEVEL control from minimum to maximum and check that the TRACKING REC CURRENT meter indicates the minimum and maximum parameters. Check all four channels in a similar manner.

m. Remove the retractable microphone from the audio and cue chassis and set the controls to allow voice announcements to be recorded on the cue track.

n. Rotate all four RECORD LEVEL controls fully counterclockwise and note the tape timer reading. Slowly advance the CH1 RECORD LEVEL control clockwise and announce the position of the control in one-half increments (one, one and one-half, two, etc.). Rotate the control from extreme clockwise and back to the extreme counterclockwise position.

o. Repeat step n for each of the four RECORD LEVEL controls. Return each control to the counterclockwise position.

p. Rewind the tape to the position noted in step n. Place the system in the playback mode. Observe the waveform monitor and note the peak indications displayed for each channel. Relate the peak indication with the position of the RECORD LEVEL control announced on the cue channel.

q. Set each RECORD LEVEL control and the memory dial behind it to the position noted in step p. Continue with step v.

NOTE

It is recommended that the record current be readjusted at least every 25 hours of head use.

r. If the video head optimizer accessory is to be used, place the system in the optimize mode by pressing the PLAY, RECORD, and RECORD OPTIMIZE pushbuttons simultaneously.

s. Set the RECORD CURRENT selector to the channel 1 position, and adjust the CH1 RECORD LEVEL control for maximum indication on the TRACKING-REC CURRENT meter or on the waveform monitor.

t. Repeat step s for channels 2 through 4.

u. Press he STOP pushbutton.

v. Note the tape timer reading and record the multiburst signal for approximately five minutes.

w. Rewind the tape to the start of the recorded multiburst signal and place the system in the playback mode.

x. Set the waveform monitor INPUT selector to A and press the VIDEO MONITOR DEMOD switch. Adjust the MASTER EQUALIZER control for optimum flat overall frequency response. Compare the recorded signal with the input multiburst signal by pressing the A/B switch during this adjustment.

y. After optimizing the overall frequency response, adjust each channel PLAYBACK EQUALIZATION control in a similar manner to optimize each individual head channel frequency response.

3-40 This completes the familiarization and checkout procedure required for record operation. Should any malfunctions or discrepancies occur during this procedure, refer to Section VIII of this manual for maintenance procedures.

3-41 Pre-Operational Checks

3-42 At the beginning of each day (or shift) of recorder use, certain pre-operational checks should be made to determine that the recorder is operating satisfactorily and that no controls have been accidentally moved from their normal positions; these checks are described in this section. In addition, procedures for checking the recorder and broadcast tapes (for "on-the-air" playback), or the recorder and input signals (for recording), are described.

3-43 Itis assumed that the user is thoroughly familiar with the recorder, that the recorder was operating properly at its last use, and that all maintenance procedures (including the daily maintenance procedures) delineated in Section VIII of this manual have been performed.

3-44 DAILY OPERATING CHECKS. The operating checks which follow should be performed daily or at the start of each shift:

a. Turn the system POWER switch to ON approximately 10 min. before the recorder is to be used.

b. If the READY indicator is lighted, press the READY pushbutton.

c. Momentarily press the warning indicator test switch; all five warning indicators should light.

d. Thread a tape on the tape transport (see Figure 3-14 if necessary); determine that the tape is correctly seated in the vacuum tape guide.

e. Make sure that no warning indicators are lighted; any malfunction must be corrected before proceeding.

f. Make sure that all chassis power switches are in the on positions and that none of the indicating fuseholders is lighted, or that none of the circuit breakers has tripped.

g. Determine that the REC LOCK OUT indicator is not lighted (unless the tape reel used is equipped with a switch actuator ring); this indicator will light if the guide vacuum is low, if the tape is improperly seated in the vacuum tape guide, or if the record lockout switch has been activated.

h. Check the vacuum gage and determine that the vacuum is 40 (±5) in. H2O.

i. Check the bearing air pressure gage and determine that the air pressure is 55 (±2) psi.

j. Determine that the following controls are set to the proper positions:

1. Main Control Panel
 - (a) SPEED
 - (b) CONTROL (set to LOCK)
 - (c) SERVO MODE
 - (d) TRACK SELECTOR (Set to HOME-TRACK)
 - (e) TIP PROJ MAN/AUTO switch
2. Head Assembly REC/PLAY lever
3. Signal System Chassis
 - (a) Standards Selector
 - (b) PLAYBACK EQUALIZATION
 - (c) RECORD LEVEL
 - (d) Modulator VIDEO GAIN
 - (e) MOD/RF DUB
 - (f) MASTER EQUALIZER
 - (g) Output Video VIDEO GAIN
 - (h) Auto-Chroma accessory control
 - (i) Dropout sensor and gate ON/OFF switch
 - (j) One line delay accessory OUT/IN switch

4. Intersync Servo System Chassis

(a) NON-STANDARD TRACKING control (set to NORMAL)

(b) HORIZONTAL STABILITY 1 and 2

(c) TAPE SPEED OVER-RIDE control selector (set to NOR)

5. Audio and Cue Chassis

(a) Cue Track RECORD LEVEL

(b) Audio Track RECORD LEVEL

(c) Cue Track INPUT Selector

(d) METER selector

6. Colortec accessory function selector

7. Amtec accessory function selector (set to REMOTE SELECT)

8. Processing Amplifier

(a) SYNC switch

(b) VIDEO CONTROLS (set to UNITY)

(c) WHITE CLIP

(d) Line standard selector

9. Velocity Compensator accessory switch

k. Press the READY pushbutton; the head drum should rotate. Set the WAVEFORM MONITOR Selector to DRUM OSC and determine that the drum oscillator is locked (the display will be stable).

l. Set the WAVEFORM MONITOR selector to CAPSTAN OSC and determine that the capstan oscillator is locked (the display will be stable).

3-45 The VR-1200B recorder at this point will reproduce standard television recordings without further checks for adjustments. Refer to Paragraph 3-48 for playback operating procedures.

3-46 BROADCAST TAPE CHECK. Prior to the time they are to be played, broadcast-tapes received from others should be checked to determine the best system settings for optimum reproduction.

NOTE

The broadcast tape may be protected from accidental erasure by using the switch actuator ring assembly 1212626 and centering disc 1212625 supplied with the recorder; refer to the instruction sheet 1212627.

a. Thread the tape on the tape transport. Press the warning indicator test switch to determine that all lamps are functional. Release the switch and determine that no warning indicators (with the exception of REC LOCK OUT, if the switch actuator ring is used) are lighted.

b. Check the recording information accompanying the tape; set the signal system video standards selector and the transport SPEED selector as required.

c. Set the PLAY/REC lever on the head assembly to PLAY.

d. Set the TIP PROJ MAN/AUTO switch to MAN.

NOTE

The user may wish to monitor the cue track during these checks to determine if any special instructions have been recorded.

e. Press the PLAY pushbutton; the system should lock up within 6 sec. If the CONTROL TRACK warning indicator is lighted, the control track level of the tape is too low. Set the WAVEFORM MONITOR selector to C.T. PLAYBACK (FILTERED) and adjust the CONTROL TRACK PLAYBACK LEVEL control (Intersync module 11) until the display fills the screen.

f. Set the WAVEFORM MONITOR selector to C.T. PLAYBACK. If the frame pulses are displaced more than 20 degrees from the peak of a positive excursion, turn on the NON-STANDARD TRACKING control.

NOTE

When this control is activated, the HOMETRACK setting of the TRACK SELECTOR does not necessarily represent true "home" track, and the HOMETRACK indicator will not be lighted.

g. Adjust the TRACKING control for maximum deflection of the TRACKING meter or set the WAVEFORM MONITOR selector to SWR RF OUTPUT and adjust the TRACKING control for a maximum indication.

h. Set the waveform monitor INPUT selector to A, and press tle VIDEO MONITOR OUTPUT pushbutton. Adjust the VIDEO GAIN control of the signal system output video module for a 1V p-p output signal.

i. Set the head assembly guide height and guide position (TIP PROJ) controls to eliminate any skewing or scalloping of the picture on the video monitor. Set the TIP PROJ MAN/AUTO switch to AUTO.

j. If the home track is exceptionally noisy or otherwise faulty, set the TRACK SELECTOR to positions 2, 3, and 4 until a satisfactory servo lock is achieved.

NOTE

If the VERT and HORIZ LOCK indicators are lighted, no further checks are necessary. If the VERT LOCK indicator does not light, set the SERVO MODE selector to NORM.

k. If the tape used includes a pre-recorded reference leader (multiburst or color bars), adjust the signal system playback equalization controls for a flat wmultiburst display on the waveform monitor or minimum color banding in the color bar display on an external color monitor.

l. Set the processing amplifier VIDEO CONTROLS selector to UNITY and adjust the VIDEO GAIN control on the signal system output video module for the proper level of p-p video.

NOTE

This is the normal method of adjusting the output level of the recorder, assuming that the processing amplifier output level switches have been properly set (refer to paragraph 2-20). It should only be necessary to adjust the levels of p-p video, pedestal, burst, and sync if the recording format was improper.

m. Set the audio and cue chassis METER selector to AUDIO and adjust the audio track PB LEVEL control so that the meter peaks at zero vu.

n. Set the controls on all accessories to the positions desired (i.e., DELAY switch to IN, Auto-Chroma accessory to AUTO, etc.).

3-47 PRE-RECORDING CHECKS. To eliminate the possibility of losing a valuable tape, or of causing inconveniene to subsequent users by recording a non-standard tape, the following procedures should be followed before a recording session:

a. Thread a degaussed tape on the transport. Press the warning indicator test switch to determine that all lamps are functional. Release the switch and determine that no warning indicators (including the FREQ indicator on the signal system AFC reference module) are lighted.

NOTE

Be sure you have enough tape for the period of recording required. Refer to Table 3-15.

b. Set the transport SPEED selector and the signal system video standards selector to the positions desired.

c. Set the REC/PLAY lever on the head assembly to REC; this will ensure that the tape is recorded with standard tip penetration.

d. Set the SERVO MODE selector to NORM.

e. Press the EE-TAPE pushbutton to select e-e mode (button unlighted).

f. Set the record amplifier MOD/RF DUB control to the desired setting.

g. Set the waveform monitor to A and press the VIDEO MONITOR DEMOD pushbutton; set the signal system output video module VIDEO GAIN control to UNITY. Adjust the modulator VIDEO GAIN control for a 1V p-p output signal.

NOTE

The signal system must be equipped with the afc accessory in order to perform step h.

h. Set the VIDEO MONITOR INPUT selector to DEMOD, and determine that the maximum white peaks of the input signal reach (but do not exceed) the level of the white level calibrate pulse; adjust the modulator VIDEO GAIN control as required.

i. Press the RECORD and PLAY pushbuttons. Check the RECORD CURRENT meter for each channel to determine that the meter readings are the same as those indicated for optimum recording at the last routine maintenance.

NOTE

If the recorder is equipped with a VHO accessory, the record current may be optimized at this time.

j. Stop the transport and rewind the tape to its original position.

k. With the audio and cue chassis METER selector set to AUDIO, adjust the audio track RECORD LEVEL control so that audio peaks from the program source read zero vu on the AUDIO meter; set the METER selector to CUE and set the cue track RECORD LEVEL control so that audio peaks from the cue source read zero vu.

l. As a convenience in later playback, 1 to 5 min of a multiburst (monochrome) or color bar (color) test signal may be recorded at the beginning of the tape; in addition, a test tone may be recorded on the audio track during this period. Information regarding the content, speed, line standard, etc. of the tape may be recorded on the cue track. Determine that the erase indicator is lighted during the period of this recording.

m. Set the waveform monitor INPUT selector to B, and check the C. T. REC. CURRENT, TACHOMETER, DRUM ERROR, CAPSTAN ERROR, CAPSTAN OSC, DRUM OSC, and REF SYNC positions of the WAVEFORM MONITOR selector to determine that the control track is being recorded properly, that the drum and capstan are locked, and that the input sync is present.

n. Stop the TAPE and rewind it to the beginning of the test signal.

o. Play back the test signal; press the AB switch to determine that the recorded signal is of essentially the same quality as the input signal.

3-48 OPERATING PROCEDURES

3-49 The completion of the pre-operational procedures ensures that the recorder is ready for operation; operating procedures for playback and record follow.

NOTE

While Ampex Corporation recommends that operation be terminated if any of the warning indicators light, it is not always necessary to interrupt programming. Loss of vacuum during playback may be compensated for with adjustments to the head assembly. Recording may also be continued under these circumstances, although the recorder will not re-enter the record mode if the transport is stopped. The Mark Ten Head Assembly should not be operated for any extended period without cooling air; it is unlikely, however, that the head assembly would sustain damage during the period of an average program.

3-50 Ampex type video tape should be used for both low- and high-band recording. Table 3-15 gives the maximum operating times for the available reels of type 148 tape. (Any time used for leaders or test signals should be deducted from these values.)

3-51 Figure 3-20 shows a VR-1200 recorder in operating position; the console doors are closed and the auxiliary doors are open. All controls necessary for the recorder are completely accessible.

3-52 Playback Operation

3-53 The operating procedures for playback are as follows:

a. Set the TIP PROJ MAN/AUTO switch to AUTO.

b. Find the beginning of the program material; stop the transport and set the tape timer to zero.

c. Back the tape up as required for cueing; be sure there is no slack in the tape.

d. Press the READY pushbutton before broadcast playback is to begin; the head drum should begin rotation.

e. Press the PLAY pushbutton before broadcast playback is to begin; the tape should be up to speed and the signal locked within a short period.

f. At any time during playback that adjustments are required, the various accessories may be adjusted in accordance with the instructions in the separate manuals for these units.

CAUTION

DO NOT PRESS THE AB SWITCH AT ANY TIME DURING BROADCAST PLAYBACK. THE OUTPUT SIGNAL WILL BE INTERRUPTED, AND THE VIDEO INPUT SIGNAL SUBSTITUTED.

3-54 Record Operation

3-55 The operating procedures for recording are as follows:

a. Find the point on the tape where recording is to begin and set the tape timer to zero.

b. Back up the tape as required for cueing; be sure there is no slack in the tape.

c. Press the READY pushbutton before recording is to begin the head drum will begin rotation.

d. To record, simultaneously press the PLAY and RECORD pushbuttons.

e. At any time during the recording period that the input level of the video or audio signals change, the appropriate level control may be adjusted.

f. Directions may be recorded at any time on the cue track during the recording by selecting the line or microphone input and pressing the CUE RECORD control (if it is not already lighted red).

Table 3-15. Tape Operating Times

PLAYING TIME IN MINUTES								
FIELD RATE IN HZ	TAPE SPEED IN IPS	1200 FOOT REEL	2400 FOOT REEL	2600 FOOT REEL	3600 FOOT REEL	4800 FOOT REEL	5400 FOOT REEL	7200 FOOT REEL
60	7.5	32	64	69	96	128	144	192
60	15	16	32	34	48	64	72	96
50	7.813	30	60	66	94	122	138	184
50	15.625	15	30	33	47	61	69	92

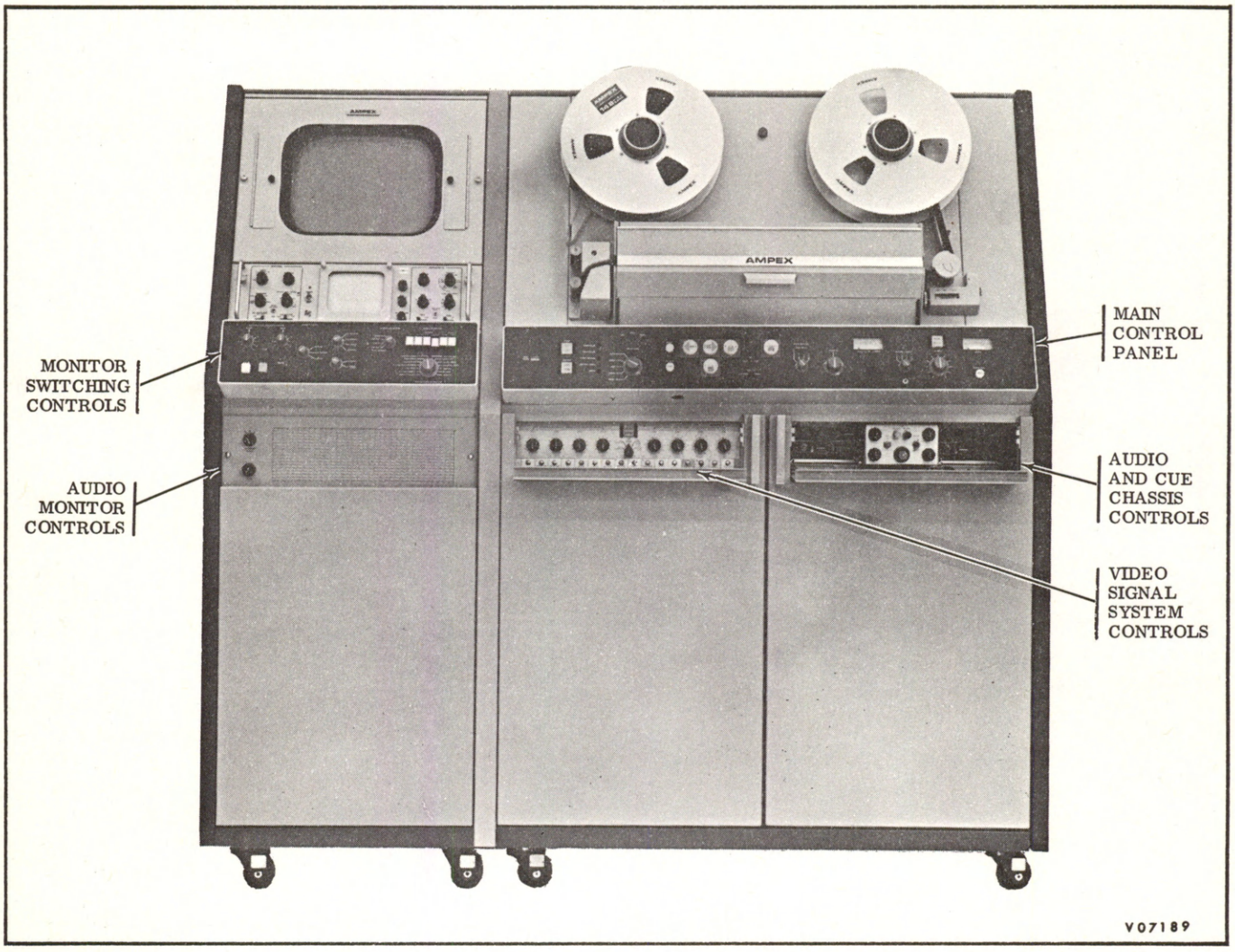


Figure 3-20. VR-1200 in Operating Position

SECTION IV

SYSTEM THEORY OF OPERATION

SECTION IV

SYSTEM THEORY OF OPERATION

4-1 SCOPE

4-2 The VR-1200B is made up of the following major subsystems (see Figure 1-1): the tape transport, the main control panel, the video signal system, the Intersync servo system, the audio and cue system, the processing amplifier, and the system power supply.

4-3 This section describes the interrelationship of these subsystems in terms of the recording and playback methods used.

4-4 OVERALL THEORY OF OPERATION

4-5 Recorded Signals

4-6 The signals recorded on the two-inch magnetic tape used in the VR-1200 include a control track signal, video track signals, a cue track signal, and an audio track signal. Figure 4-1 shows a typical section of tape, including all these signals; the track width allotted to each type of signal and the relationship between the tracks is also shown.

4-7 Rotary Head Recording

4-8 Although longitudinal-track video recorders have been employed successfully, it is both difficult and impractical to use this method of recording video signals; the bandwidth required for satisfactory recording of a color video signal calls for tape speeds over 1,000 inches-per-second (ips). This would mean that a minute of recorded video would require almost a mile of tape.

4-9 Rather than moving magnetic tape past a fixed head, the rotary head recording system moves both tape and head. In the VR-1200, tape is moved past the head at a rate of 7.5 or 15 ips. The video head itself, however, is rotating at 240 revolutions-per-second (rps) for 60-field standards, or 250 rps for 50-field standards.

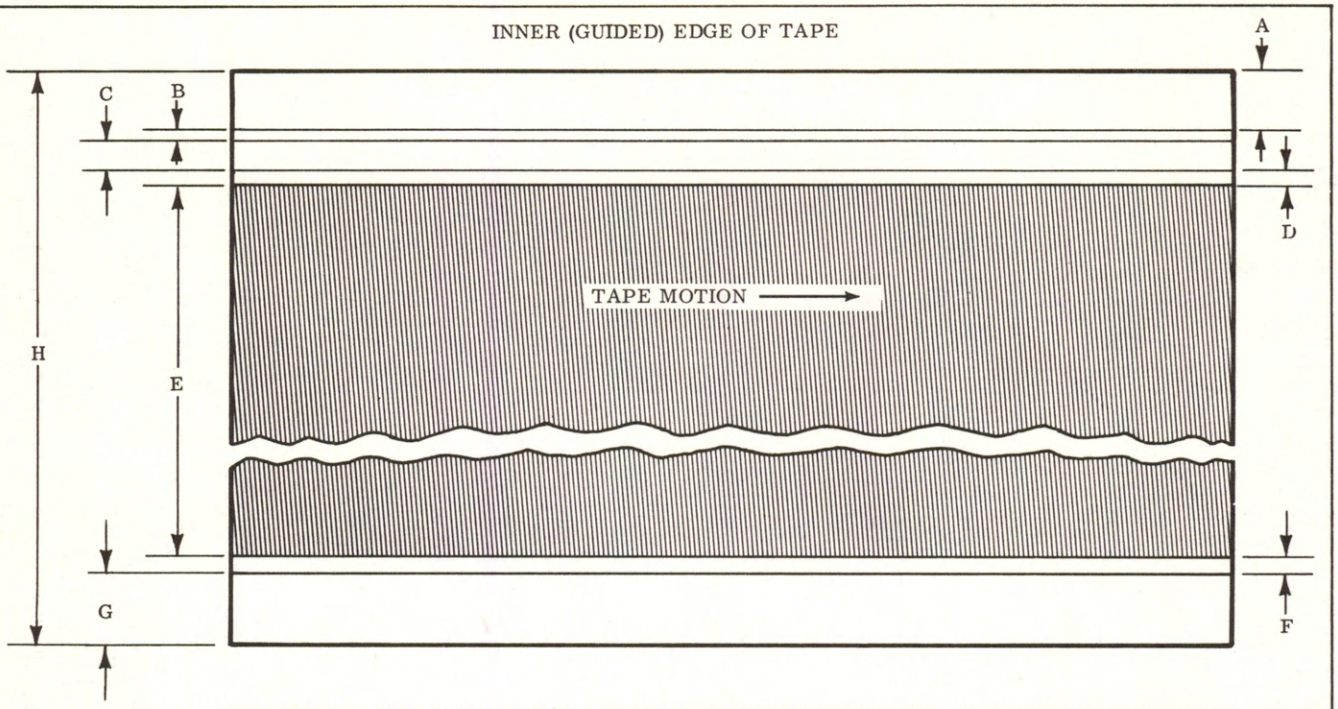
4-10 There are four video heads, mounted 90 degrees apart on a video head drum; each head passes across the tape once for each revolution of the head drum. At a forward tape speed of 15 ips, and a rotational drum speed of 240 rps, the head-to-tape velocity is approximately 1500 ips.

4-11 The width of the recorded video track is equivalent to the width of the video head tip on the head drum. At a forward tape speed of 15 ips, using the 10-mil (0.010 inch) head assembly, the guard band between video tracks is 5.6 mils; using the 5-mil head assembly at 15 ips, the guard band is 10.6 mils. In either case, the center-to-center track spacing is 15.6 mils.

4-12 At a forward tape speed of 7.5 ips, using the 5-mil head assembly, the guard band between tracks is 2.8 mils and the center-to-center track spacing is 7.8 mils. (The 5-mil head assembly must be used for 7.5 ips recording, and may be used for 15 ips recording; the 10-mil head assembly may only be used at 15 ips.)

4-13 Under the 525-line, 60-field television standard, each pass of a head across the tape records 16 or 17 lines of video. The 525 lines that constitute a complete frame are contained in 32 successive parallel tracks that occupy a total of one-half inch (12.7 millimeters) of tape length at 15 ips; the vertical blanking interval always occurs in the center of a video track.

4-14 Figure 4-2 shows the relationship between the recorded video tracks, the placement of the vertical blanking interval, and the control track signal. The control track



REFERENCE DIMENSION	USAGE	(INCHES) MINIMUM	(INCHES) MAXIMUM	(MILLIMETERS) MINIMUM	(MILLIMETERS) MAXIMUM
A	CONTROL TRACK	0.045	0.050	1.14	1.27
B	GUARD BAND	0.010	0.010	0.26	0.26
C	CUE TRACK	0.015	0.020	0.38	0.58
D	GUARD BAND	0.010	0.010	0.26	0.26
E	VIDEO	1.815	1.820	46.10	46.23
F	GUARD BAND	0.020	0.020	0.52	0.52
G	AUDIO TRACK	0.065	0.070	1.65	1.78
H	TAPE WIDTH	1.996	2.000	50.70	50.80

Figure 4-1. Tape Track Location

signal is recorded by the Intersync servo system, and indicates the instantaneous position of each head as a function of 240 hertz (or 250 hertz) square-wave phase. In addition, a frame pulse at the beginning of each new frame of video is recorded on the control track.

4-15 The preceding comments about recording generally apply to playback.

4-16 Video Recording Method

4-17 Video information is recorded in the form of a variable-frequency carrier. The modulator used in the VR-1200 is basically a voltage-controlled multivibrator; the output frequency of the modulator is a function of the input voltage.

4-18 The format of the video signal used (i.e., the peak-to-peak video level, and the ratio of sync amplitude, burst amplitude, and pedestal or blanking level to peak-to-peak video level or to each other) is established by the FCC or CCIR; the VR-1200 modulator should be supplied with a 1 volt peak-to-peak video signal.

4-19 With the video input at ground potential (the modulator VIDEO GAIN control at the maximum counterclockwise position) the multivibrator output signal is at a frequency which will correspond to the level at the tip of sync (blanking level for afc-equipped systems). With the VIDEO GAIN control at UNITY, and a 1 volt peak-to-peak input signal, the modulator frequencies will be as shown in Table 5-2.

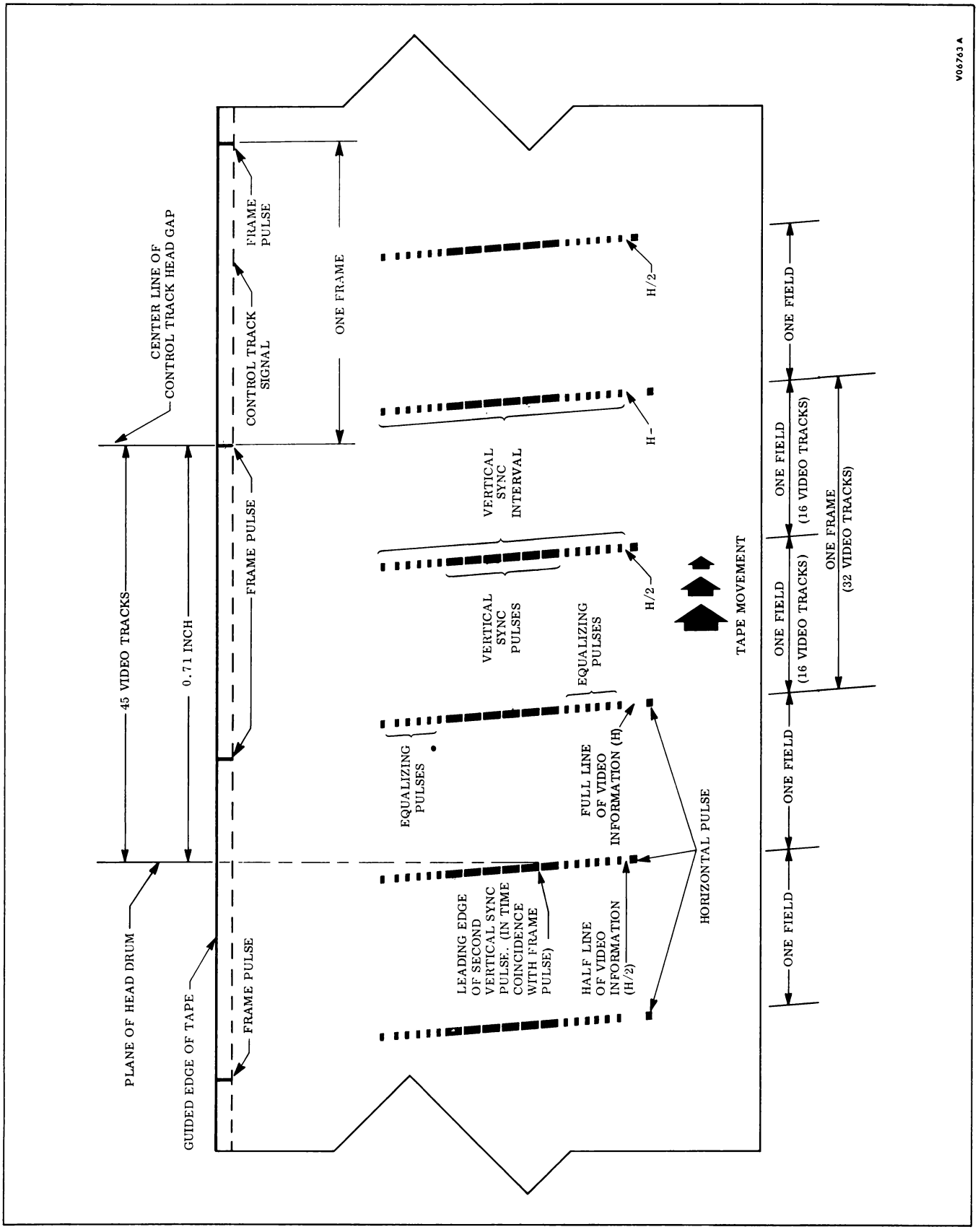


Figure 4-2. Video Track Spacing

4-20 Audio Recording Method

4-21 The method of recording audio and cue signals is identical to that used in any high-quality audio recorder; tape (in this case, a portion of the two-inch tape) is moved past fixed audio heads, and the signal is recorded with high-frequency bias.

4-22 Servo System

4-23 The capstan (forward tape speed control) and head drum motors are controlled by the Intersync servo system, which ensures that recorded and reproduced video is tightly locked to the local sync reference, signal sync, or the local power line frequency.

4-24 A tachometer pickup on the drum motor shaft feeds a square wave back to the servo system; the instantaneous frequency of this signal is representative of the instantaneous rotational speed of the head drum, and the phase is representative of the position of the head drum. The square wave signal is recorded on the control track of the tape.

4-25 The frequency of the head drum tach signal is divided by four (to 60 hertz for 60-field standards, or 62.5 hertz for 50-field standards) in the servo system, then amplified and used to drive the capstan motor.

4-26 During playback, the signals on the control track are used to duplicate the condition of capstan and head drum speed and position that prevailed at the time of the recording. Complete theory of operation for the Intersync servo system is contained in manual 1809927.

4-27 TAPE TRANSPORT THEORY

4-28 General

4-29 This section also contains the theory of operation of the tape transport used in the VR-1200B. The mechanical assemblies of the tape transport are described in detail, as are the bearing air, cooling air, and vacuum systems.

4-30 The various magnetic heads used in the VR-1200B are mounted on the tape transport, but are not electrically part of it. However, as the purpose of a tape transport consists mainly of moving magnetic tape at a constant speed past magnetic heads, the head assemblies themselves will be described. The units which provide the driving signals for these heads are described in later sections.

4-31 Detailed information about the Mark Ten Head Assembly may be found in manual 1809956.

4-32 Tape Transport Components

4-33 The components which are mounted upon the tape transport surface are illustrated in Figure 4-3; the bearing air, cooling air, and vacuum systems (mounted behind the tape transport) are used exclusively for the Mark Ten Head Assembly, and are shown in later illustrations.

4-34 Tape transport operation is controlled by the system control unit on commands initiated at the VR-1200B control panel. The sequence of operations is delineated in Section VII.

4-35 Tape Drive Mechanisms

4-36 CAPSTAN ASSEMBLY. The capstan assembly includes a two-speed hysteresis-synchronous motor, a flywheel, and a belt-driven capstan. The motor is driven by two-phase variable-frequency power from the Intersync servo system. A mylar belt between the motor shaft and the capstan shaft transmits the rotating motion, and reduces the speed by a factor of 3.

4-37 CAPSTAN IDLER. The capstan idler (pinch roller) is a wide rubber tire, supported by a solenoid-operated yoke. With the activation of the recorder play bus, the solenoid rotates the yoke so that the tape is clamped between the capstan shaft and the pinch roller. After 3.8 seconds, a short-circuit is removed from resistors R7006 and R7007 (in series with the capstan solenoid) in the system control unit; this eliminates the common solenoid problem of torque change with rising temperature, and maintains steady capstan idler to capstan shaft tension.

4-38 During record or playback operation, the capstan, the magnetic tape, the control track head, and the Intersync servo system form a closed loop for maintaining accurate forward tape speed.

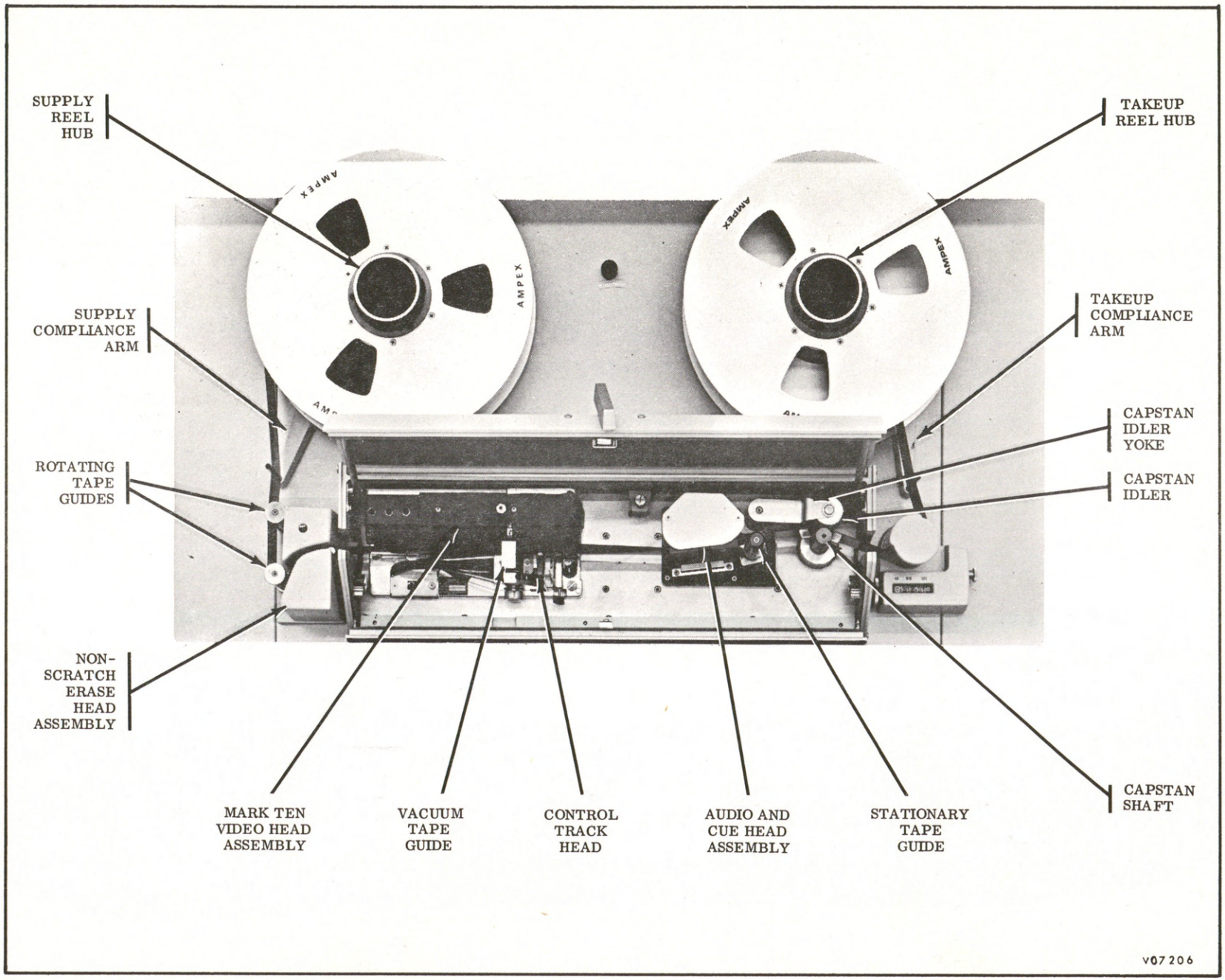


Figure 4-3. Tape Transport Surface Components

4-39 In any transport mode other than those mentioned, the capstan idler solenoid remains de-activated, and the capstan idler is retracted by a spring.

4-40 SUPPLY REEL TURNTABLE. The supply reel turntable includes a reel hold-down assembly, a drive motor, a solenoid-operated brake assembly and a record lock-out switch (described in Section III). Figure 4-4 shows the supply reel turntable and its components. The turntable itself is mounted on the shaft of the drive motor, which protrudes through the top plate of the tape transport.

4-41 Motor Operation. The supply reel motor is a heavy-duty induction type. When the VR-1200B is in the rewind mode, this motor receives full line voltage and produces maximum clockwise torque. In the fast forward mode, series resistor R7001 is inserted in the motor supply line so that sufficient holdback torque is created to eliminate any possibility of tape spill-ing. When the recorder is in the play or record modes, the supply reel motor is powered through R7004, and provides the amount of holdback torque required for proper tape tension.

4-42 Brake Assembly. The supply reel turntable brake is on the motor shaft extension at the rear of the motor; the brake is normally engaged. During all modes of recorder operation that involve tape movement, power is applied to the brake solenoid and the brake is released. In addition, the brake may be released by manually holding one of the compliance arms in the outward position, or by stepping on an optional foot brake release switch.

4-43 TAKEUP REEL TURNTABLE. The takeup reel turntable assembly is essentially similar to the supply reel turntable with the following exceptions:

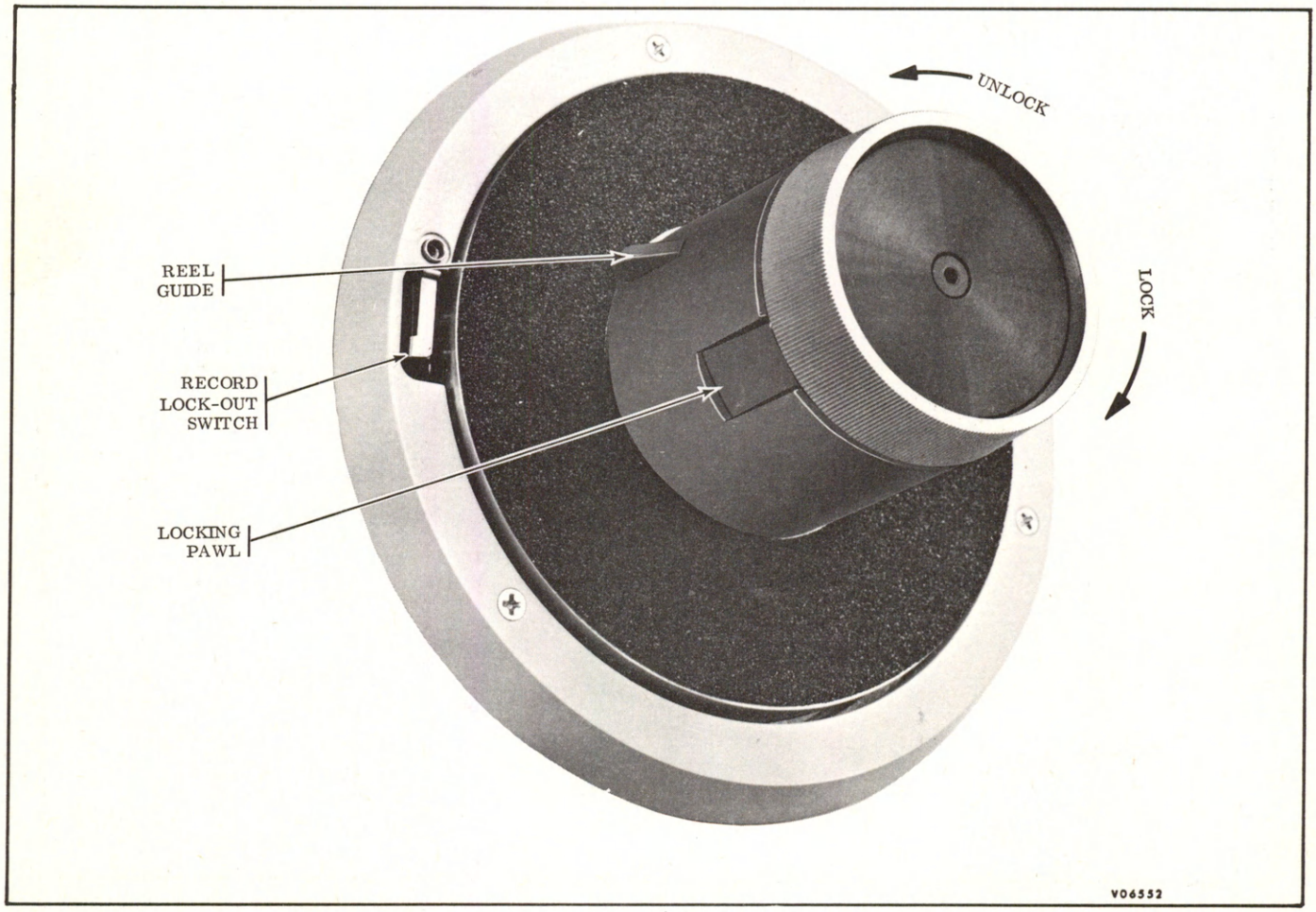


Figure 4-4. Supply Reel Turntable

4-43 TAKEUP REEL TURNTABLE. The takeup reel turntable assembly is essentially similar to the supply reel turntable with the following exceptions:

a. The takeup reel turntable does not include a record lockout switch.

b. The torque produced is counterclockwise.

c. The brake assembly is similar, but not interchangeable.

d. The takeup reel includes a tape motion sensor (refer to paragraph 4-45).

4-44 When the recorder is in the play or record modes, the takeup motor normally runs with series resistors R7002, R7003, and R7005 in one lead. For the first 1.5 seconds of tape movement, however, resistors R7003 and R7005 (in parallel) are short-circuited by the system control unit. This action ensures maximum torque at initiation so that the tape is brought up to speed quickly, and easily overcomes the inertia of the takeup reel.

4-45 TAPE MOTION SENSOR. A tape motion sensor at the rear of the takeup reel turntable motor prevents the simultaneous entry of conflicting modes of operation. The tape motion sensor consists of a slippage assembly, a switch actuator pawl, and two microswitches. Any tape motion will cause one of these switches to become activated, and prevent the entry of any mode which could cause tape spillage or tape damage.

4-46 COMPLIANCE ARMS. There are two spring-loaded compliance arm assemblies mounted on the tape transport (see Figure 4-3) which ride on the backing side of the tape. If tape tension is lost, or if no tape is on the transport, each arm will fall inward and activate a normally closed switch; power to the reel motors and to the brake assemblies will be interrupted, stopping the transport. Causes of insufficient tape tension include:

a. Broken tape

b. End of tape

c. Improperly threaded tape.

4-47 If either compliance arm is swung outward, it engages a normally open switch which applies power to the brake solenoids; tape threading is more easily accomplished when the brakes are released in this manner.

4-48 The movement of the compliance arms is damped by silicone fluid to assure smooth, consistent action in damping momentary changes in tape tension that may occur due to reel imbalance, the passage of a mechanical splice, etc.

4-49 Air and Vacuum Systems

4-50 The bearing air, cooling air, and vacuum systems are all provided for the operation of the Mark Ten Head Assembly. Figure 4-5 shows the mounting on the transport top plate for the head assembly, and the ports for the air and vacuum systems.

4-51 Ampex air-bearing video heads include a pin which is used to activate the head-in-place switch. If no head is in place, or a ball-bearing head is mounted, the air compressor will not start and the circuits which normally protect the air-bearings from damage caused by a lack of bearing air will be de-activated. Conversely, if the head-in-place switch is activated, the air compressor will run and the protective interlocks will function.

4-52 BEARING AIR SYSTEM. Bearing air from the remote air compressor is brought into the VR-1200B through the snap-action fitting located directly below the bearing air pressure gage (see Figure 2-1 and Figure 4-6).

4-53 Bearing air pressure is regulated at 55 (±2) psi, and filtered by the bearing air filter to remove dust and excess humidity. When the collected precipitate reaches a predetermined level in the air filter bowl, it is discharged through the tube shown in Figure 2-1.

4-54 The air-bearing pressure switch is part of the protective interlock for the air-bearing video head. If the bearing air pressure drops to 50 (±2) psi, the BEARING AIR warning indicator will light. At 40 (±2) psi, head drum power from the Intersync servo system will be interrupted, preventing damage to the highly-polished surfaces of the air

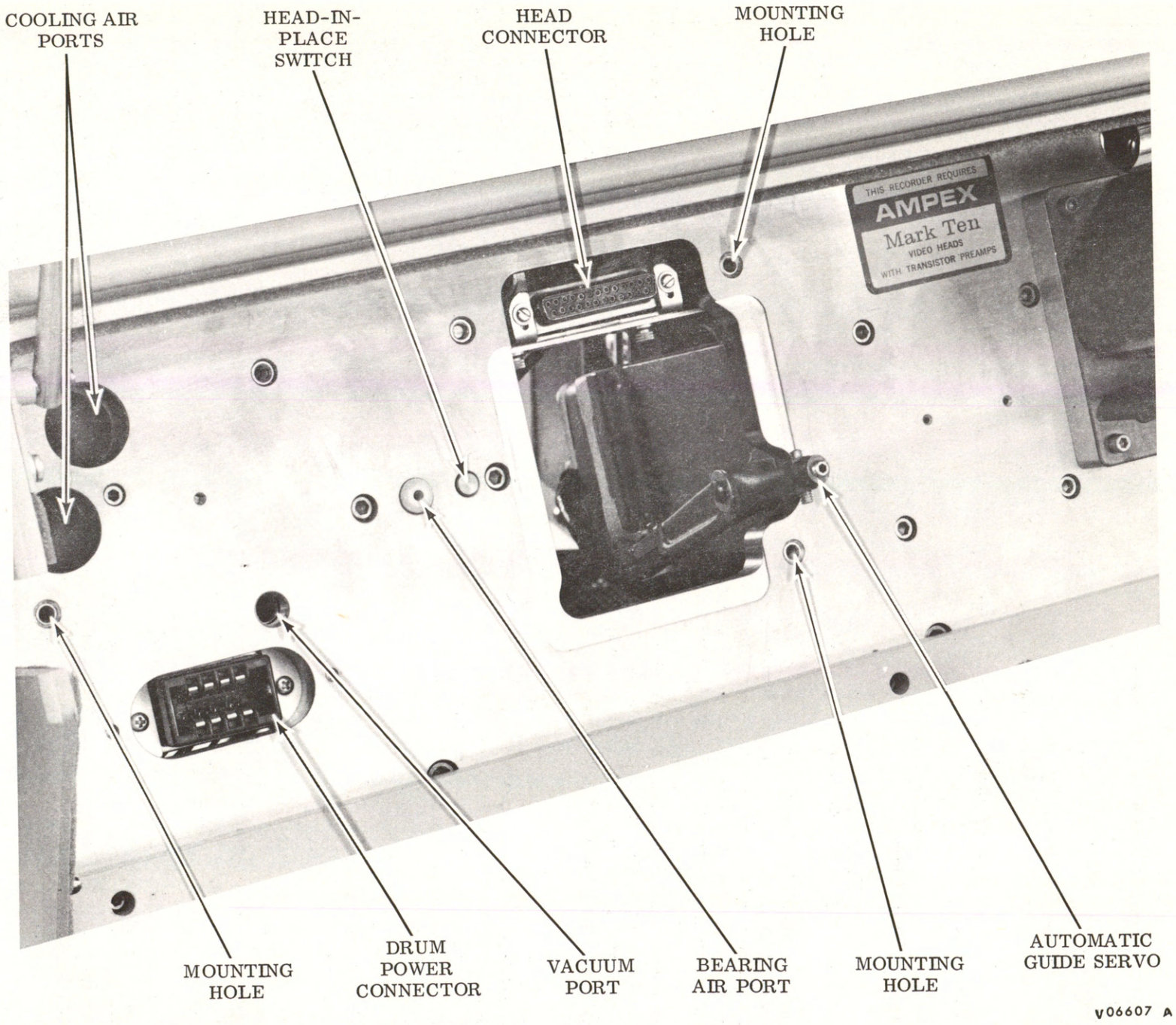


Figure 4-5. Video Head Assembly

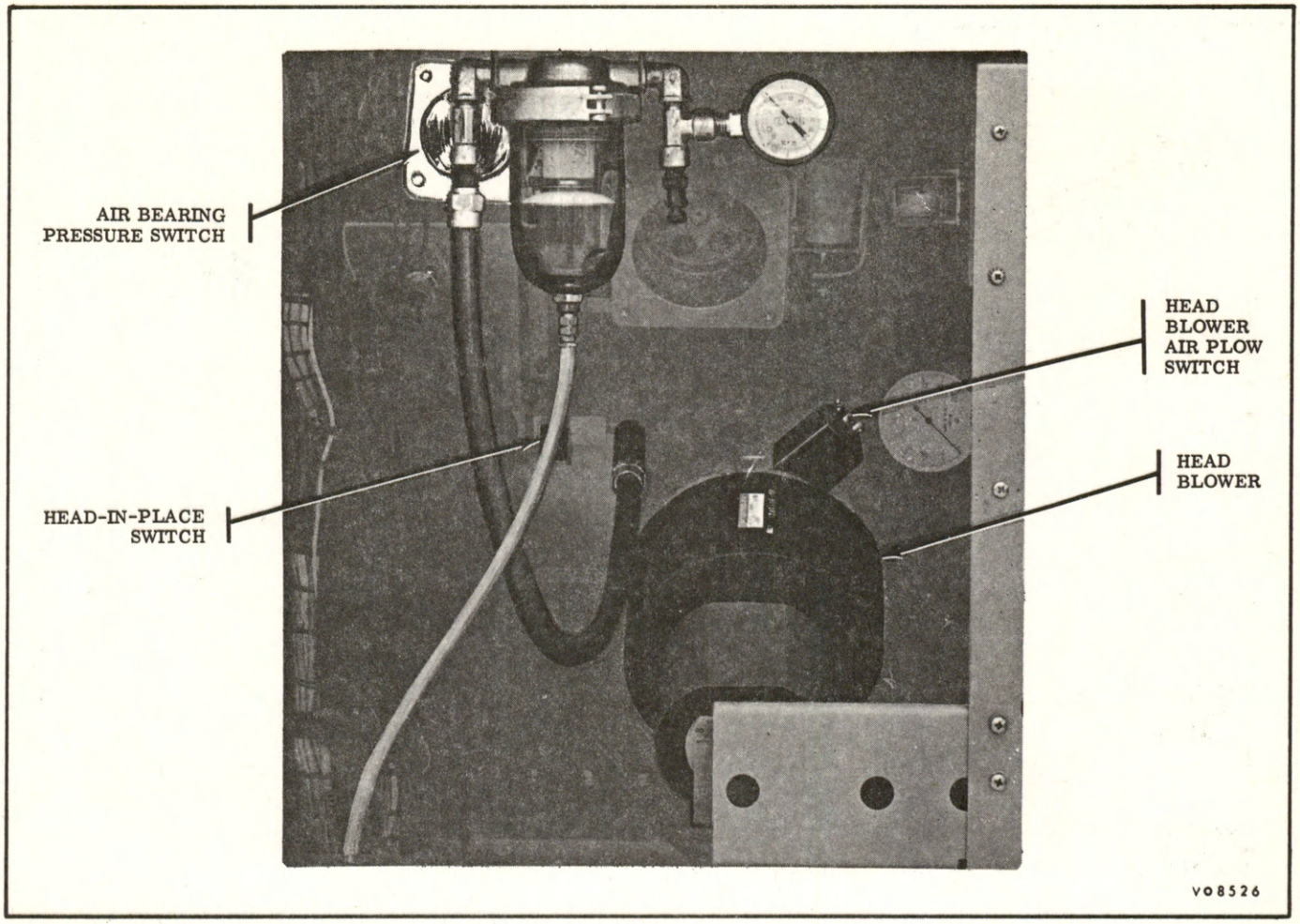


Figure 4-6. Bearing Cooling Air Components

bearings in the head assembly, and tape motion will cease.

4-55 COOLING AIR SYSTEM. The cooling air system (see Figure 4-5 and Figure 4-6) serves the dual function of cooling the head drum and drum motor in the Mark Ten Head Assembly, and constantly vacuum-cleaning the head drum to remove dust and tape oxide. (The head blower is turned on by the system control unit whenever the head drum is rotating.)

4-56 The head blower is a squirrel-cage unit which draws air from the atmosphere over the video head drum, through the drum motor housing, through the cooling air ports in the transport top plate, through a hose and filter, past an air flow switch, finally exhausting the air downward into the atmosphere.

4-57 Modern magnetic tapes do not lose their oxide coating, or "shed" as readily as earlier tapes, but there is still a certain amount of oxide build-up which takes place around the video head drum. For maximum efficiency, the video heads must be kept scrupulously clean and free of tape oxide and dust; the cooling air system accomplishes part of this task.

4-58 The air flow switch activates the COOLING AIR warning indicator if cooling air is absent, or if the filter is so dirty that it is restricting air flow.

4-59 VACUUM SYSTEM. The vacuum system of the VR-1200B (see Figure 4-7) is used to form the magnetic tape to the concave shape of the head assembly vacuum tape guide.

4-60 The vacuum pump assembly includes the vacuum pump, an intake filter for the

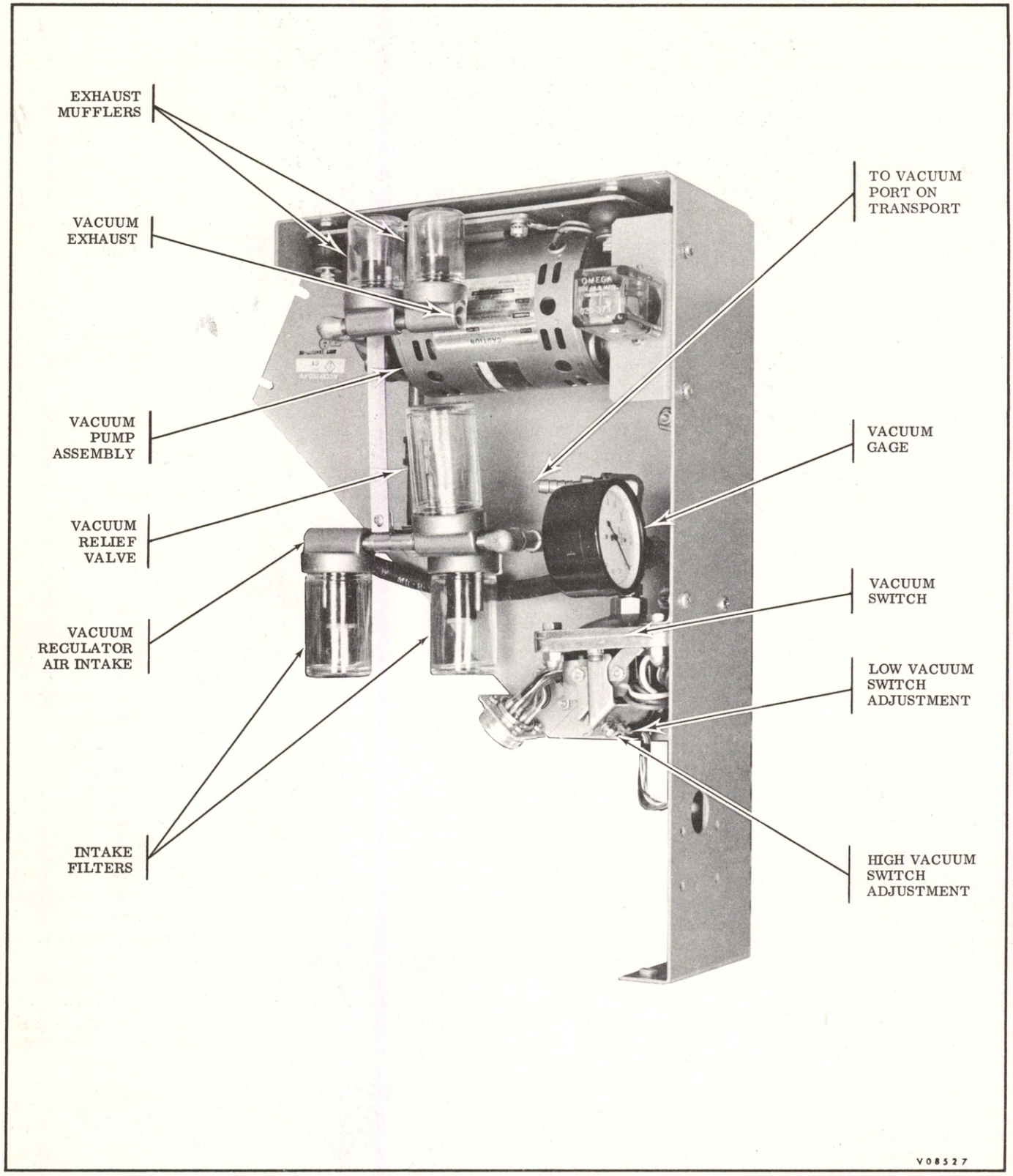


Figure 4-7. Vacuum System Components

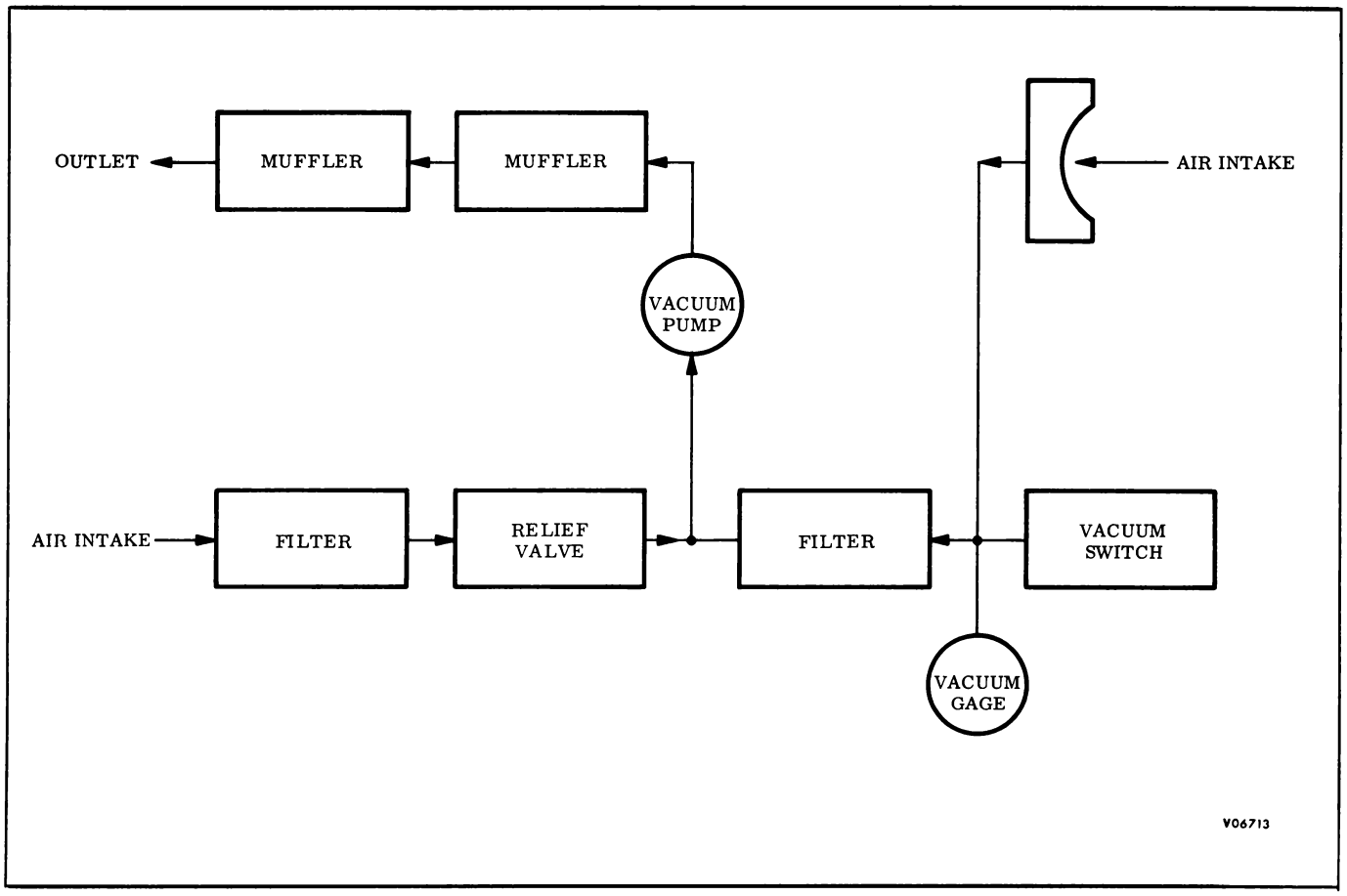


Figure 4-8. Vacuum System Flow Diagram

4-61 The guide vacuum is maintained at 40 (±2) inches of water; if the vacuum drops below 30 (±2) inches, the vacuum switch will activate and the GUIDE VACUUM and REC LOCK OUT warning indicators will light. The GUIDE VACUUM indicator will light if the vacuum rises above 50 inches.

4-62 Magnetic Head Assemblies

4-63 Figure 4-9 shows a representation of the magnetic heads used in the VR-1200B during the record mode. During the play mode, all erase heads will be deactivated and the record/playback heads will couple information back to the chassis.

4-64 Video Head Assemblies

4-65 NON-SCRATCH ERASE HEAD ASSEMBLY. The increase in tape tension during the brief period when tape is accelerating or decelerating, together with the minute particles of tape aside that accumulate on the full-width video erase head has in the past been a principal cause of tape scratching. Tape scratching is revealed by the presence of a number of partial dropouts distributed along diagonal lines across the reproduced picture. This problem was partially eliminated by the use of a retractable erase head assembly in earlier models of the VR-1200 recorder.

4-66 The problem has been completely eliminated in the VR-1200B by the use of a non-scratch erase head assembly located on the backing side of the tape. The oxide surface of the tape is not contacted at any time, totally preventing any scratching. The non-scratch erase head assembly is shown in Figure 4-3 and Figure 4-10. Drive for this

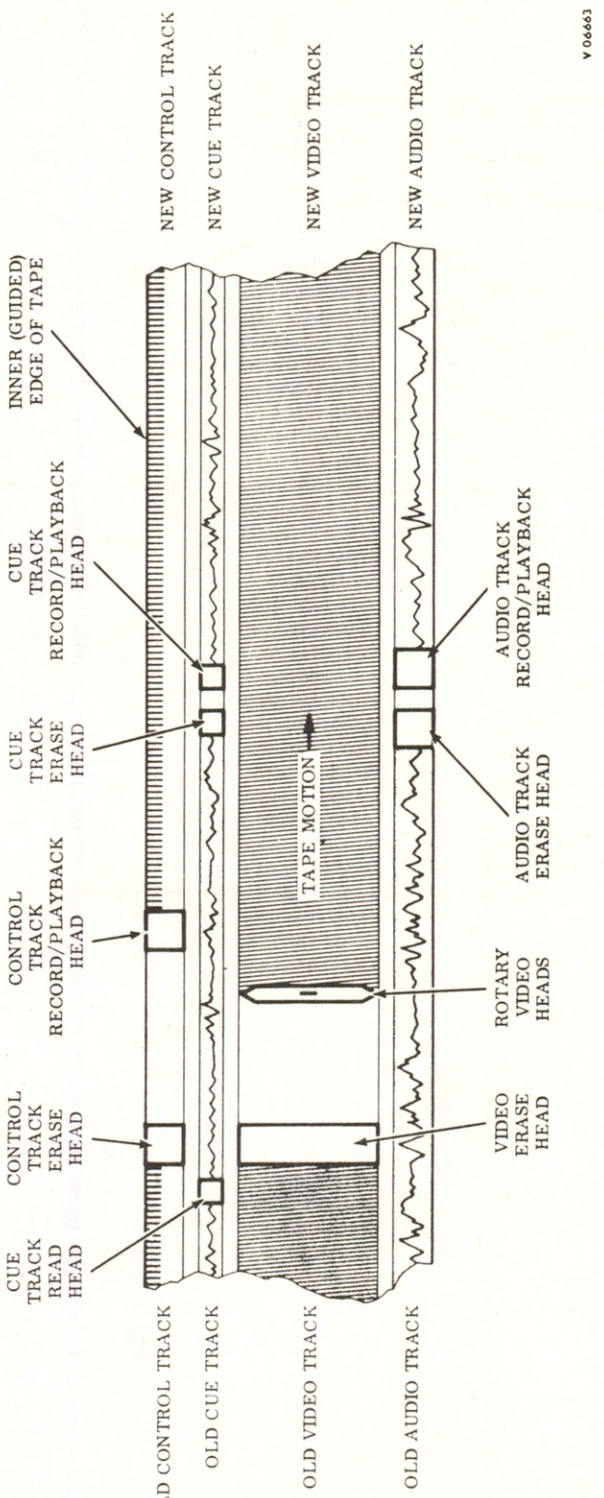


Figure 4-9. Magnetic Head Location

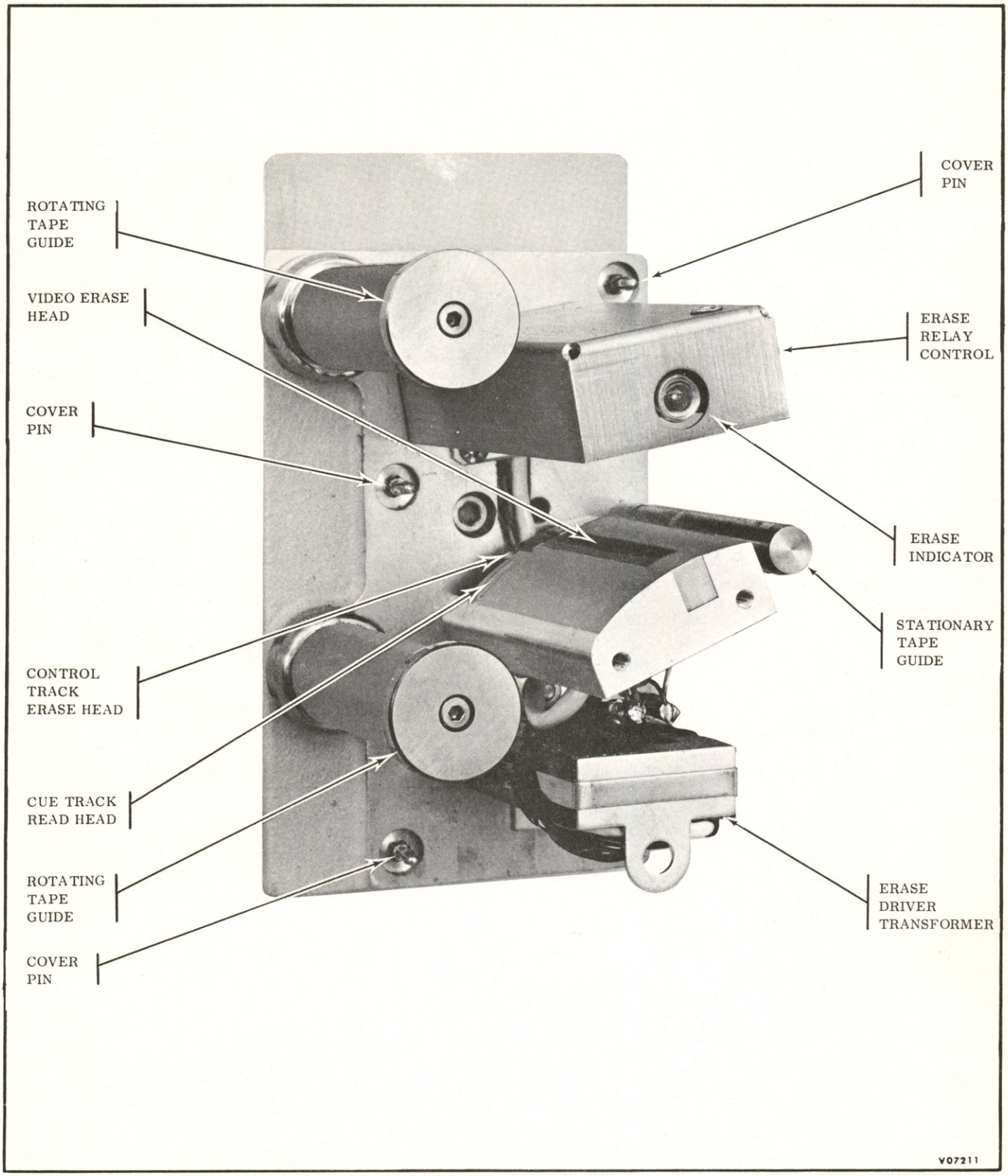


Figure 4-10. Non-Scratch Erase Head Assembly

head is provided by the video erase driver (refer to paragraph 5-166).

4-67 MARK TEN HEAD ASSEMBLY. The Mark Ten Head Assembly is shown in Figures 4-3 and 4-11; the mating pneumatic and electrical connections on the tape transport top plate are shown in Figure 4-5. The complete assembly is built on a rigid base plate which is fastened to the transport with three screws.

4-68 Head Drum Motor. An air-bearing hysteresis synchronous motor is driven by square-wave ac from the Intersync servo system; the nominal driving frequency is 240 hertz in 60 field systems and 250 hertz in 50 field systems. The instantaneous frequency of the driving power may vary, however, depending upon the positional correction the Intersync servo system is required to make.

4-69 The drum motor armature is supported by air bearings which cause it to float in a nearly frictionless condition upon a thin layer of air (refer to paragraph 4-52).

4-70 Video Head Drum. The video head drum is mounted on the drum motor armature shaft; four video heads are mounted 90 degrees apart on the head drum. The video head drum rotates at a nominal speed of 14,400 rpm in 60-field operation or 15,000 rpm for 50-field operation.

4-71 Drum Tachometer. A magnetic tachometer is also mounted on the drum motor shaft, and is used to feed head-position information back to the Intersync servo system.

4-72 Rotary Transformer. Each video head on the head drum is connected to the primary winding of a rotary transformer mounted on the drum motor shaft. The primary windings rotate within the secondary windings, which are mounted on the base plate of the head assembly. The secondary winding leads are attached to a small printed-circuit connector which mates with the transistor preamplifier connector.

4-73 Transistor Preamplifier. The transistor preamplifier is built as a plug-in module, and includes the mating connectors for the rotary transformer and the head connector assembly. The preamplifier is described in paragraphs 5-54 and 5-60.

4-74 Vacuum Tape Guide. The surface of the vacuum tape guide, which faces the video head drum, is curved at the same radius as the video head drum; there is a small vacuum chamber in the vacuum tape guide which holds tape at this radius throughout all recording and playback operations. In addition, the vacuum tape guide includes a shoulder at its inside edge (closest to the transport top plate) to stabilize the inner (guided) edge of the tape.

4-75 Vacuum Tape Guide Solenoid. The vacuum tape guide solenoid, energized during the record or play modes, advances the vacuum tape guide toward the video head drum; the ultimate position is determined by the setting of the manual TIP PROJ control or the automatic guide servo. The vacuum tape guide solenoid is activated in the record and playback modes 3.8 seconds after initiation. In all other modes of operation, the vacuum guide is retracted.

4-76 Audio, Cue, and Control Track Head Assemblies

4-77 CONTROL TRACK HEADS. The control track erase head is located within the non-scratch erase head assembly, and is operative in the VR-1200B record mode or when commanded by the Electronic Editor; it is driven by the video erase driver assembly.

4-78 The control track record/playback head is an integral part of the Mark Ten Head Assembly; connections to the Intersync servo system are made through the head drum connector. This head records and plays tachometer signals and frame pulses longitudinally on the inside (guided) edge of the tape.

4-79 CUE TRACK HEADS. Erase and record/playback heads for the cue track are located in the audio and cue head assembly (see Figure 4-3). The cue track heads are connected to the audio and cue chassis, and record (or play) a longitudinal track located between the control track and the video track. In addition, the non-scratch erase head assembly contains a cue track read head for editor and editec operation.

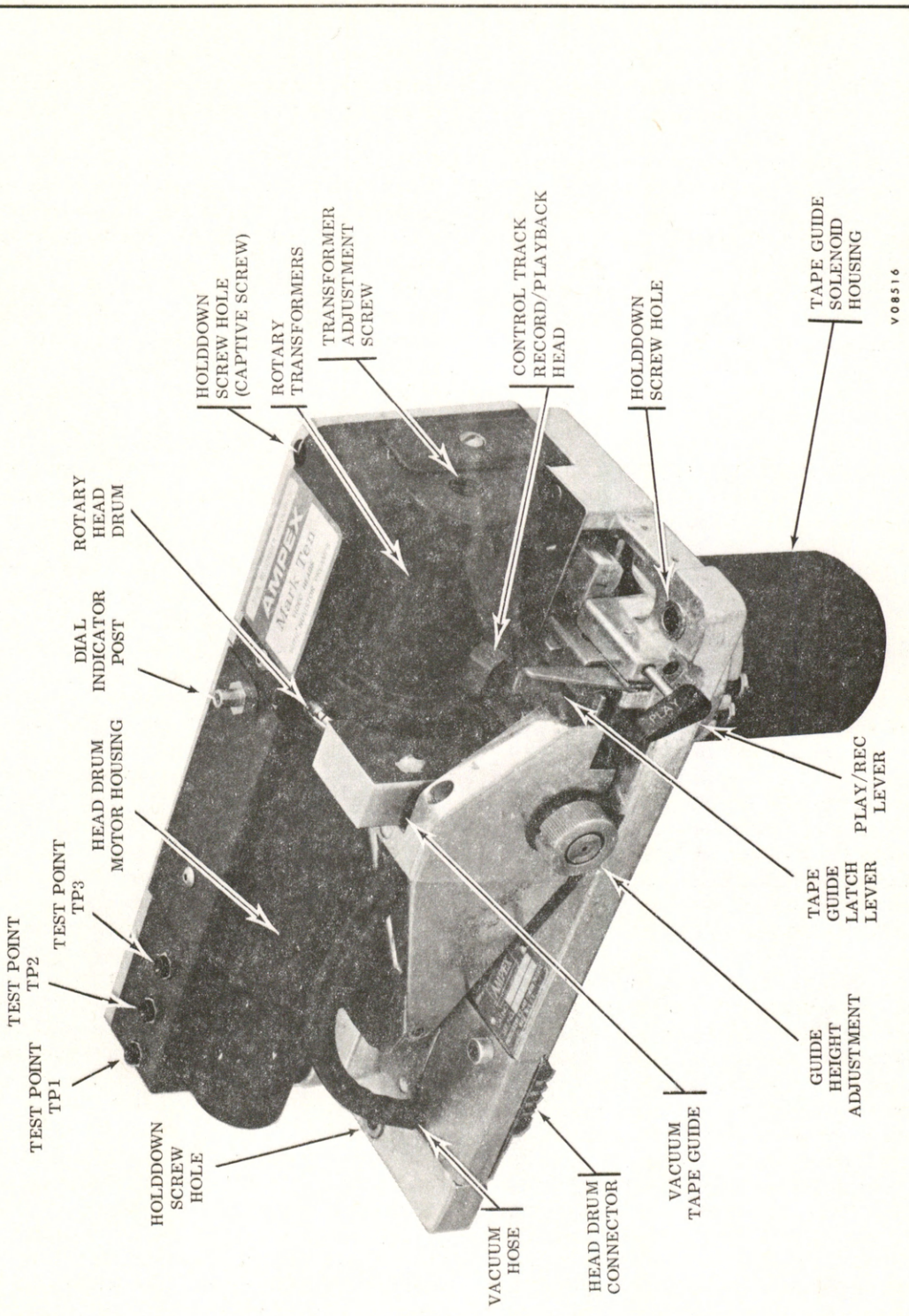


Figure 4-11. Mark Ten Head Assembly

4-80 AUDIO TRACK HEADS. Erase and record/playback heads for the audio track are located in the audio and cue head assembly (see Figure 4-3). The audio track heads are also connected to the audio and cue chassis, and record or play a longtudinal track on the outer surface of the tape. The audio track is farther away from the video track than is the cue track, is not located next to the control track, and is wider than the cue track (see Figure 4-1). Therefore, the audio track does not share the control track pickup problems of the cue track, does not require a notch filter, and is generally of higher quality.

4-81 MONITOR CONSOLE THEORY

4-82 The monitor console contains an audio monitor, a video monitor, a waveform monitor, and switches which allow application of various signals to these monitors.

4-83 Audio Monitoring and Switching

4-84 AUDIO SWITCHING. See schematic drawing no. 1385364. The AUDIO MONITOR selector switch, S1, mounted on the monitor switch panel, can be positioned to select one of the following inputs: audio line input or output, cue channel input or output, or a spare audio channel. The selected input is transformer coupled to monitor switch panel audio output connector J½3 and connected by cables to the audio monitor.

4-85 AUDIO MONITOR. See schematic drawing no. 1385014. The MONITOR INPUTS switch allows the application of either the audio channel (selected at the monitor switch panel), cue channel, or auxiliary channel to an audio amplifier circuit. The selected input is applied through LEVEL control R1 to the base of transistor Q4. Transistors Q4 and Q5 form a differential amplifier; the input to Q3 is feedback from the output stages.

4-86 The emitters of Q3 and Q4 are connected to their current source through R5, R7, R6, and R12. The collector of Q3 is connected to the emitter of Q6 and the collector of Q4 is connected directly to the negative 20 volt supply.

4-87 Transistors Q2 and Q6 are constant-current generators; the current through both flows from a positive 40 volt potential to a negative 40 volt potential. Under no-signal conditons in the audio amplifier, the current through each transistor is equal; the currents are dissipated in R11, R15, R13, and R7. The voltage at the collectors of Q2 and Q6 (therefore the voltage at the bases of Q1 and Q5) is zero, and drivers Q1 and Q5 are cut off.

4-88 However, if a signal is present at the collector of Q3, the altered bias on the emitter of Q6 will cause Q6 to draw more or less current (depending upon the instantaneous polarity of the ac signal). If the bias on the emitter of Q6 alters the conduction of Q6 (disturbing the no-signal current balance between Q6 and Q2), Q2 will supply a difference current through the base of either Q1 or Q5.

4-89 Q1 and Q5 are complementary emitter followers that drive the bases of Q1 and Q2 (heat-sink mounted). If the drivers are cut off, no signal is applied to the bases of Q1 and Q2.

4-90 The principal difference between the output amplifier (Q1 and Q2 on the heat sink) and a conventional class B transistor amplifier is that no forward bias is required in this circuit to eliminate crossover distortion. A plot of collector current against base current will show virtually no non-linearity (therefore no period when neigher transistor is conducting when an ac signal is present) because the current transfer ratio of the transistor is linear. When the constant-current source emplyed by this amplifier design is used, the crossover region is linear, and no forward bias is required to compensate for crossover distortion.

4-91 The speaker, LS1, is connected to the common emitter output of Q1 and Q2 through a current-limiting resistor, R14. R13 provides a load for Q1 and Q2 when high-impedance headphones are used. R14 provides a voltage drop at the common emitters of Q1 and Q2 regardless of the dc resistance of the speaker voice coil; this voltage is used in the dc feedback loop to protect the output transistors.

4-92 High-frequency roll-off above 25 kilohertz is provided by resistor R3 and capacitor C1 in the ac feedback path to the base of Q3; distortion-reducing negative

feedback is coupled to Q3 through R3 and C4. The total distortion products of this circuit are less than one percent.

4-93 There is also a dc feedback path through R4 to the base of Q3; when power is initially applied, the emitters of the output transistors may not be at ground potenial. The negative dc feedback to Q3 changes the balance of current generators Q2 and Q6 and shifts the operating point of the output transistors back to ground. This prevents the flow of dc current through the voice coil of LS1 when there is no input signal present, and stabilizes the operating point of Q1 and Q2 when the amplifier is in the active state.

4-94 Operating voltage for the audio amplifier is provided by an internal power supply. The ac power for the supply is applied through indicators fuse F1 to the primary of transformer T1. The secondary winding center tap is grounded; the potential between each of the other terminals and ground is 24 volts.

4-95 This voltage is used to drive four separate power supplies; diodes CR7 and CR8 and filter capacitor C10 form a negative 20 volt full-wave rectifier. The positive and negative 20 volt power supplies furnish the current used to operate the audio power amplifier stages.

4-96 Capacitor C13, diodes CR2 and CR6, and filter capacitor C11 form a voltage-doubler circuit which derives negative 40 volts from the 24 volt ac input. Capacitor C12, diodes CR1 and CR5, and filter capacitor C8 form a voltage-doubler which provides positive 40 volts. These two voltage-doublers function as bias supplies.

4-97 Video Monitoring and Switching

4-98 VIDEO SWITCHING. See schematic drawing no. 1385364. VIDEO MONITOR switch S2 consists of six interlocked pushbutton switches which control the input to the video monitor. Five pushbuttons are used to switch video signals; the sixth switches a control line.

4-99 Each video input is connected to the common terminal of a single-pole, double-throw relay. The normally-closed contact of each relay is connected to a 75-ohm termination. Therefore each input, whether selected for display or not, will be peroperly terminated. Pressing a pushbutton activates the relay for that input (connecting the selected signal to the monitor) and applies power to the lamp behind that pushbutton.

4-100 The STABILITY MARKER pushbutton employs a double-pole switch; pressing this button lights the lamp and activates the stability marker circuit (located in the Intersync servo chassis) by removing ground potential from the marker control input.

4-101 VIDEO MONITOR. The video monitor is a 14-inch television monitor with pulse-cross features. Information on the video monitor is provided in a separate manual.

4-102 Waveform Monitoring and Switching

4-103 WAVEFORM SWITCHING. See schematic drawing no. 1385364. The WAVEFORM MONITOR switch S3 is a single-pole, 14 position rotary switch which controls the input to the waveform monitor. Some positions of the switch also include dc biasing networks to properly center the displays on the waveform monitor crt without the necessity of adjusting the POSITION control for each waveform. The source impedance of the waveform monitor switcher matches the input impedance of the waveform monitor.

4-104 WAVEFORM MONITOR. The waveform monitor is a slide-mounted oscilloscope, and is covered by a separate manual.

SECTION V

VIDEO SIGNAL SYSTEM THEORY

SECTION V

VIDEO SIGNAL SYSTEM THEORY

5-1 SCOPE

5-2 This section contains operating theory for the components in the video signal path. The video signal system is covered in detail, including the head preamplifier module of the Mark Ten Head Assembly.

5-3 The processing amplifier manual, 1809989, is supplied with the unit and contains complete theory of operation. The function and signal-path location of the processing amplifier are described in this section. Similarly, the Amtec and Colortec accessories are briefly described, but no attempt is made to repeat the information in Amtec manual 1809923, Colortec manual P59560, or Universal Colortec manual 1809984. (These manuals are supplied with the respective accessories.)

5-4 Video signal system accessories, then, are not described in detail, but instead the accessory is briefly described as it is reached in the signal path.

5-5 VIDEO SIGNAL SYSTEM THEORY

5-6 Video Signal Path Components

5-7 Figure 5-1 is a block diagram of the video signal electronics in the VR-1200B. The record and playback electronics are contained in the signal system chassis; the head preamplifier is part of the Mark Ten Head Assembly. The processing amplifier, and the Amtec, Colortec, and Velocity Compensator accessories are separately-mounted units.

5-8 The signal system chassis (see Figure 3-5) contains ten plug-in modules and has space for six more accessory modules (refer to Table 5-1).

5-9 Record Mode Electronics

5-10 The record mode electronics consists of a modulator (module 2), a record amplifier (module 5) and portions of the video standards selector (S1). Also used are portions of an AFC clamp circuit (module 3) and AFC reference circuit (module 4). Figure 5-2 is a functional block diagram of the signal system record mode electronics.

5-11 A composite video signal (approximately 1 volt peak-to-peak, negative-going sync) is coupled to the modulator through coaxial connector J4 on the signal system external connector panel. The modulator is a voltage-controlled fm generator; the output frequency of the modulator is proportional to the instantaneous dc level at its input. Table 5-2 shows the proper white level, blanking (black) level, and sync tip level modulator frequencies for each position of the video standards selector. An automatic frequency control (afc) accessory, which fits into the module 3 and module 4 positions of the signal system, will accurately maintain these frequencies without any adjustment by the operator.

5-12 The video signal is pre-emphasized in the video standards selector (S1); the quality of the pre-emphasis is a function of the video standards selected for use (525 MONO, 525 COLOR, etc.). Frequency control is also determined in the standards selector (refer to Table 5-2). Table 5-3 shows the configuration and values for the pre-emphasis, frequency, control, and de-emphasis

Table 5-1. Signal System Modules

MODULE NUMBER	MODULE	MODULE NUMBER	MODULE
1		9	Demodulator
2	Modulator	10	Low-pass filter
3	Afc clamp*	11	Output video
4	Afc reference*	12	Sync processing
5	Record amplifier	13	Dropout sensor and gate**
6	Channel amplifiers	14	Autochroma 1*
7	Rf switcher and equalizer	15	Autochroma 2*
8	Switcher logic	16	One-line delay*

**Accessory*

***Requires modules 3, 4, and 16 to perform all its functions.*

Table 5-2. Level to Carrier Frequency Correlation

STANDARDS SELECTOR POSITION	WHITE LEVEL CARRIER FREQUENCY	BLANKING LEVEL CARRIER FREQUENCY	SYNC TIP CARRIER FREQUENCY (NOMINAL)
525 MONO	6.80 MHz	5.00 MHz	4.28 MHz
525 COLOR	6.50 MHz	5.79 MHz	5.50 MHz
525 HIGH BAND	10.00 MHz	7.90 MHz	7.06 MHz
625 LOW BAND	6.80 MHz	5.54 MHz	5.00 MHz
625 HIGH BAND	9.30 MHz	7.80 MHz	7.16 MHz

functions of the standards selector. The 525-line standards are in conformance with SMPTE recommended practice; the 625-line standards are in conformance with CCIR recommended practice.

5-13 The record amplifier accepts rf from the modulator or from an external source (generally another vtr). The four identical outputs of the record amplifier are fed through the head connector assembly and the head preamplifier (passive in the record mode) to the video heads in the Mark Ten Head Assembly. Each head records approximately 17 lines of video per pass across the tape.

5-14 Playback Mode Electronics

5-15 The playback electronics consists of a head preamplifier, a channel amplifier (module 6), an rf switcher and equalizer (module 7), switcher logic (module 8) a demodulator (module 9), a low-pass filter (module 10), output video (module 11), sync processing

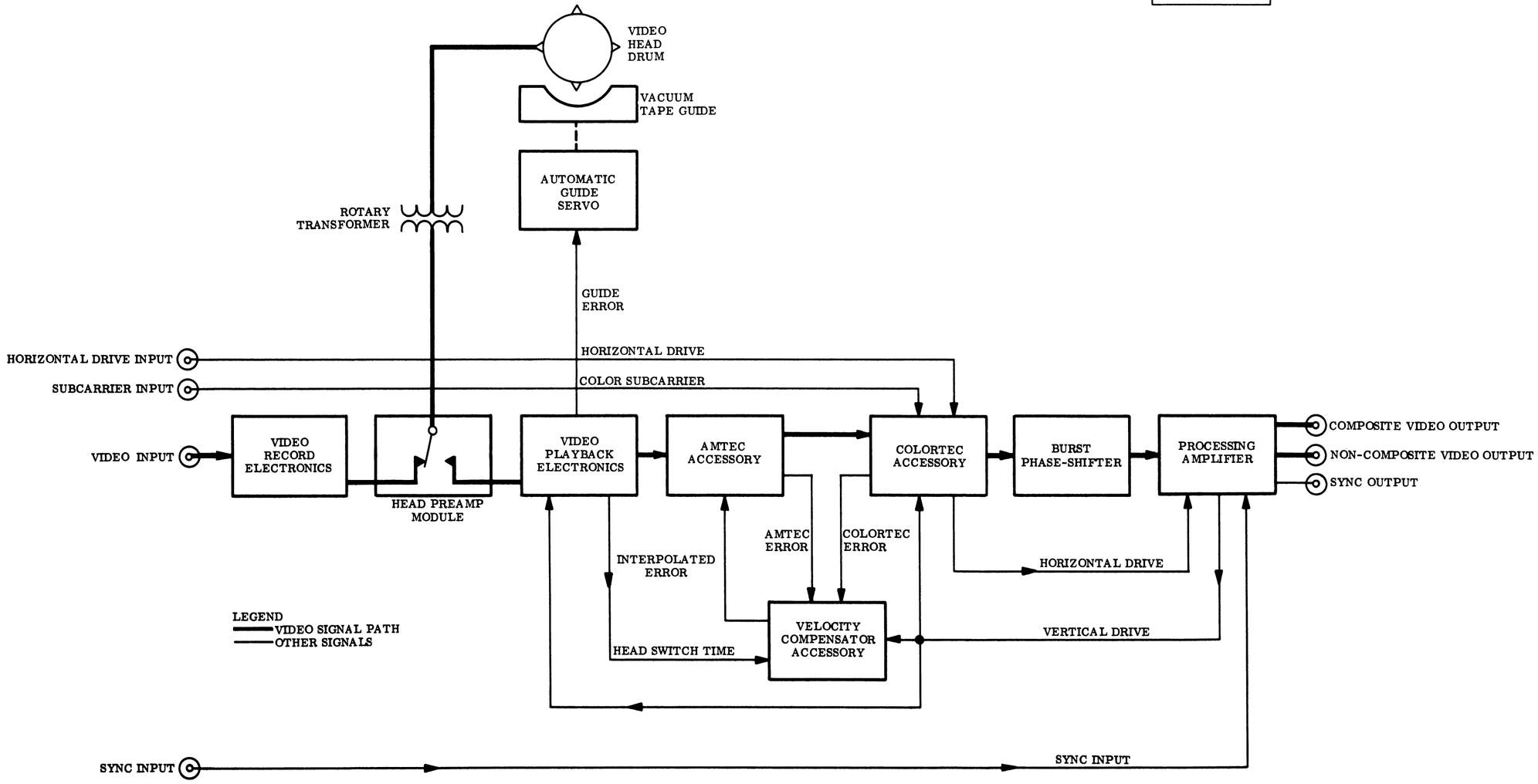


Figure 5-1. Video Signal Electronics, Block Diagram

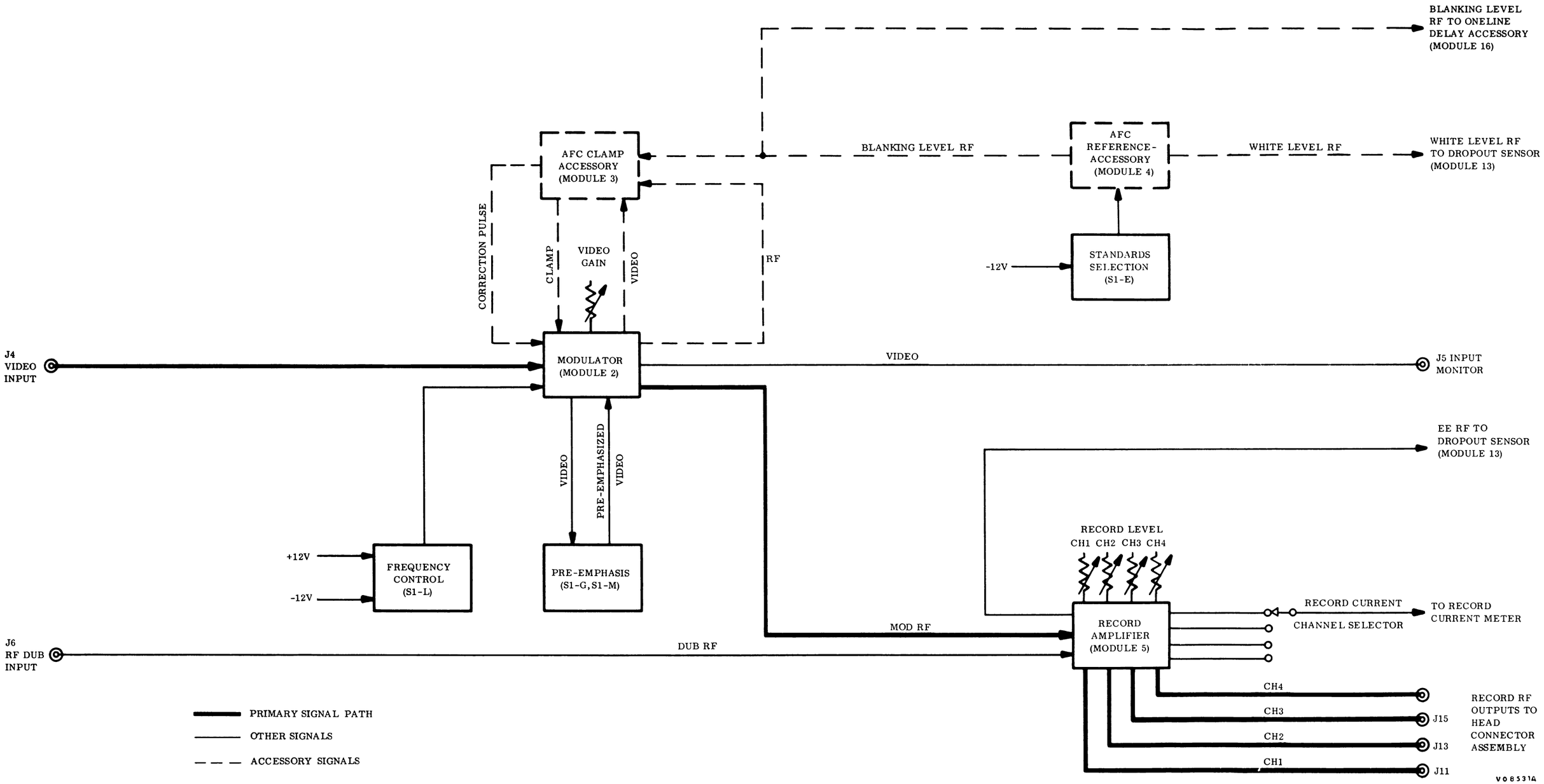
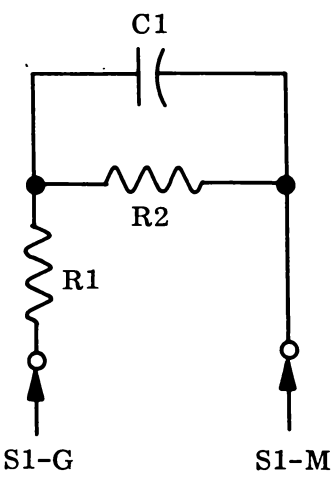
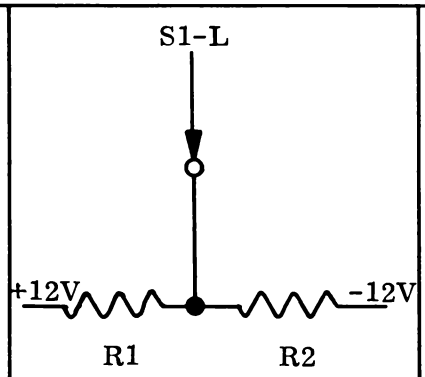
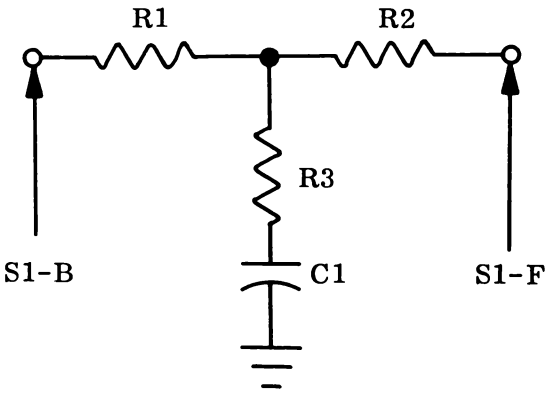


Figure 5-2. Video Signal System Record Electronics, Functional Block Diagram

Table 5-3. Video Standards Selector Component Values







STANDARDS SELECTOR POSITION	PRE-EMPHASIS CIRCUIT COMPONENT VALUES			FREQUENCY CONTROL CIRCUIT COMPONENT VALUES		DE-EMPHASIS CIRCUIT COMPONENT VALUES			
	R1	R2	C1	R1	R2	R1	R2	R3	C1
525 MONO	8.72 ohms	634 ohms	207.9 pF	16.2 kohms	12.4 kohms	555 ohms	555 ohms	78.7 ohms	335.2 pF
525 COLOR	115 ohms	1740 ohms	138.3 pF	5620 ohms	30.1 kohms	174 ohms	174 ohms	20 ohms	1655 pF
525 HIGH BAND	121.9 ohms	407.8 ohms	1471 pF	2490 ohms	9760 ohms	660 ohms	660 ohms	245 ohms	979.6 pF
625 LOW BAND	221 ohms	732 ohms	214.7 pF	7870 ohms	18.2 kohms	374 ohms	374 ohms	113 ohms	471.1 pF
625 HIGH BAND	223.4 ohms	560 ohms	1071 pF	2430 ohms	13 kohms	460.5 ohms	460.5 ohms	178.6 ohms	1345 pF

(module 12), a dropout sensor and demodulator input gate (module 13), and portions of the video standards selector (S1). Figure 5-3 is a block diagram of the signal system playback electronics.

5-16 The amplified outputs of the heads are coupled through coaxial cables to the channel amplifier (module 6), then to the switcher and equalizer (module 7). The switcher logic (module 8) accepts head drum position information in the form of a tachometer (tach) signal, and converts this to a switching squarewave. The switcher and equalizer accomplishes its head switching function in accordance with these signals. Except for the master equalizer, equalization of the four playback channels is separately adjusted by the four equalization controls on the control panel of the signal system or by the Auto-Chroma 2 accessory (color signals only).

5-17 The demodulator (module 9) accepts rf from the switcher and equalizer or from the record amplifier (in the e-e mode) through the dropout sensor and demodulator input gate (module 13). The one-line delay accessory is available to eliminate any effect that tape dropouts might have upon the quality of the signal going into the demodulator in the tape playback mode.

5-18 The demodulator has two outputs; the rf dub output (through coaxial connector J7) feeds tape rf to another video recorder for copies. The other output is fed to the low-pass filter (module 10).

5-19 The signal at the input of the low-pass filter is a series of equal-amplitude equal-width pulses (the pulse-repetition frequency will be proportional to the carrier frequency of the recorded rf). One output of the low-pass filter is a series of dc levels which comprise a composite video signal; this output is fed to the output video module (module 11) where it is de-emphasized, amplified, and fed through J20 to the processing amplifier (through the time-base correction accessories if these are in use).

5-20 Another output of the low-pass filter is fed to the sync processing module (module 12) where the sync pulses are extracted for use as horizontal triggering pulses for the Intersync servo system.

5-21 RECORD MODE DETAILED THEORY

5-22 Modulator (Module 2)

5-23 FEEDBACK AMPLIFIER. The composite video input signal (nominally 1 volt peak-to-peak) is coupled through pin 3 of J002 to a feedback amplifier composed of Q4 through Q8 (see Figure 5-4, block diagram of the modulator). As this type of feedback amplifier is used in several places throughout the signal system, it will be described in some detail here.

5-24 Transistors Q7 and Q8 form a differential amplifier; incoming video is fed into one input and a portion of the video from the output of amplifier Q4, Q5 is fed into the other input. The difference between the two signals is amplified and coupled through emitter follower Q6 to amplifier Q4, Q5. In this application, the feedback amplifier has a gain of 4.

5-25 The output stage of the feedback amplifier is a single-ended push-pull amplifier, Q4 and Q5. The amplifier functions as a low-ouput impedance, wide-band current amplifier (voltage gain is approximately unity) which responds quickly to the instantaneous changes in dc level which comprise the video signal.

5-26 Figure 5-5 is a simplified schematic diagram of a single-ended push-pull amplifier. With no input signal, Q1 and Q2 (both biased into conduction) pass equal amounts of current; there is no resultant output signal. R2 and R3 form a voltage divider, as do R5 and R6. C2 and C3 are filter capacitors.

5-27 A positive-going input signal will drive Q1 into heavier conduction and cause it to pass more current from the positive 12-volt supply through R2 and the load resistor

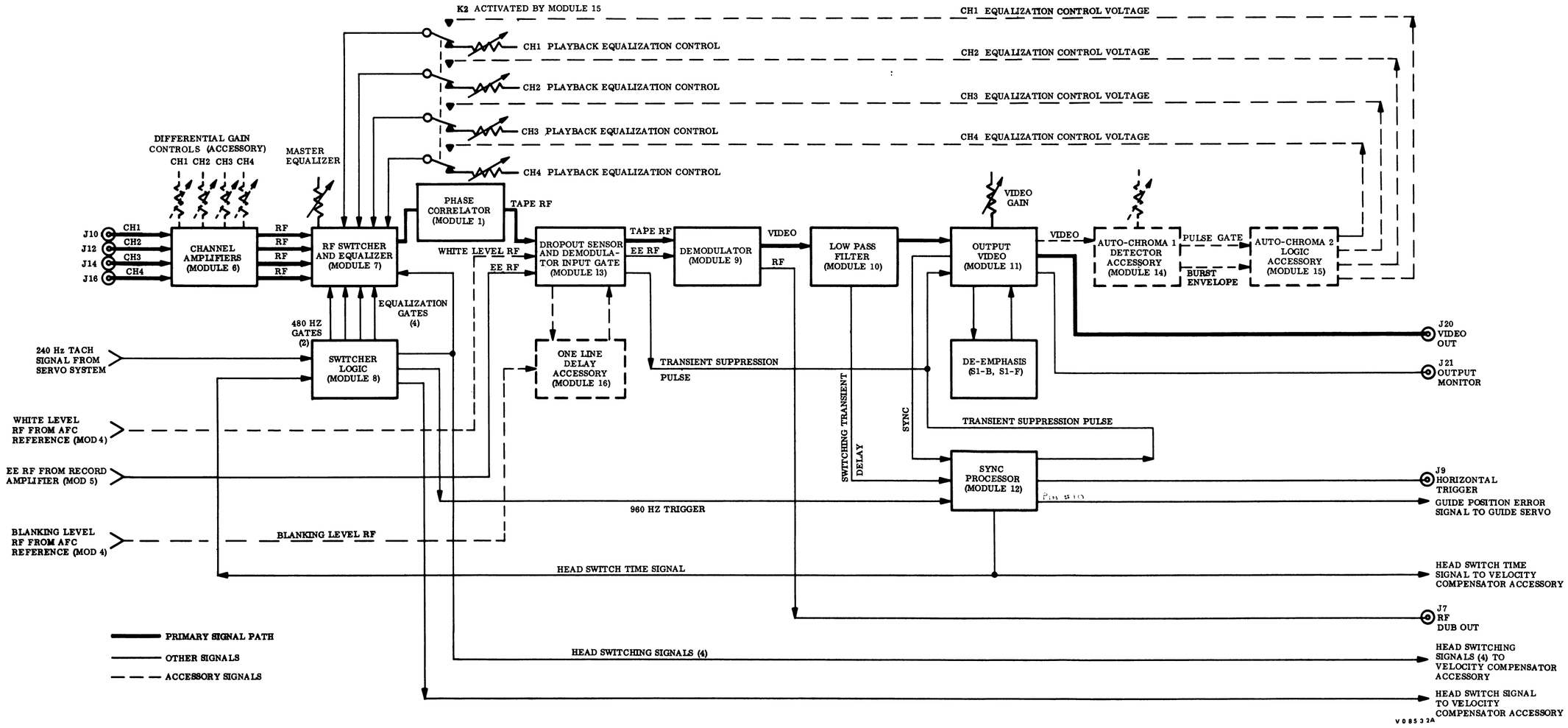


Figure 5-3. Video Signal System Playback Electronics Functional Block Diagram

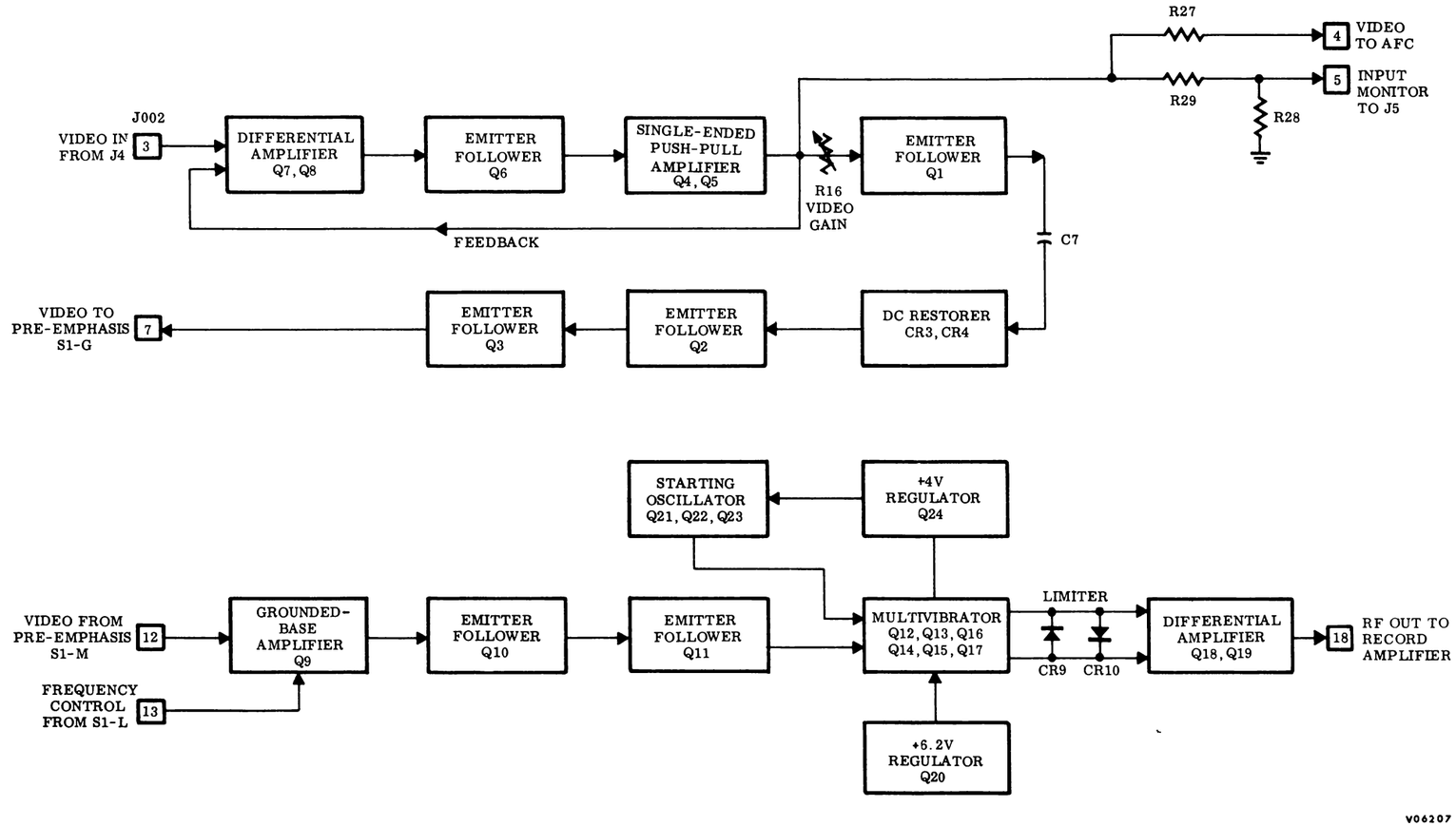


Figure 5-4. Modulator Functional Block Diagram

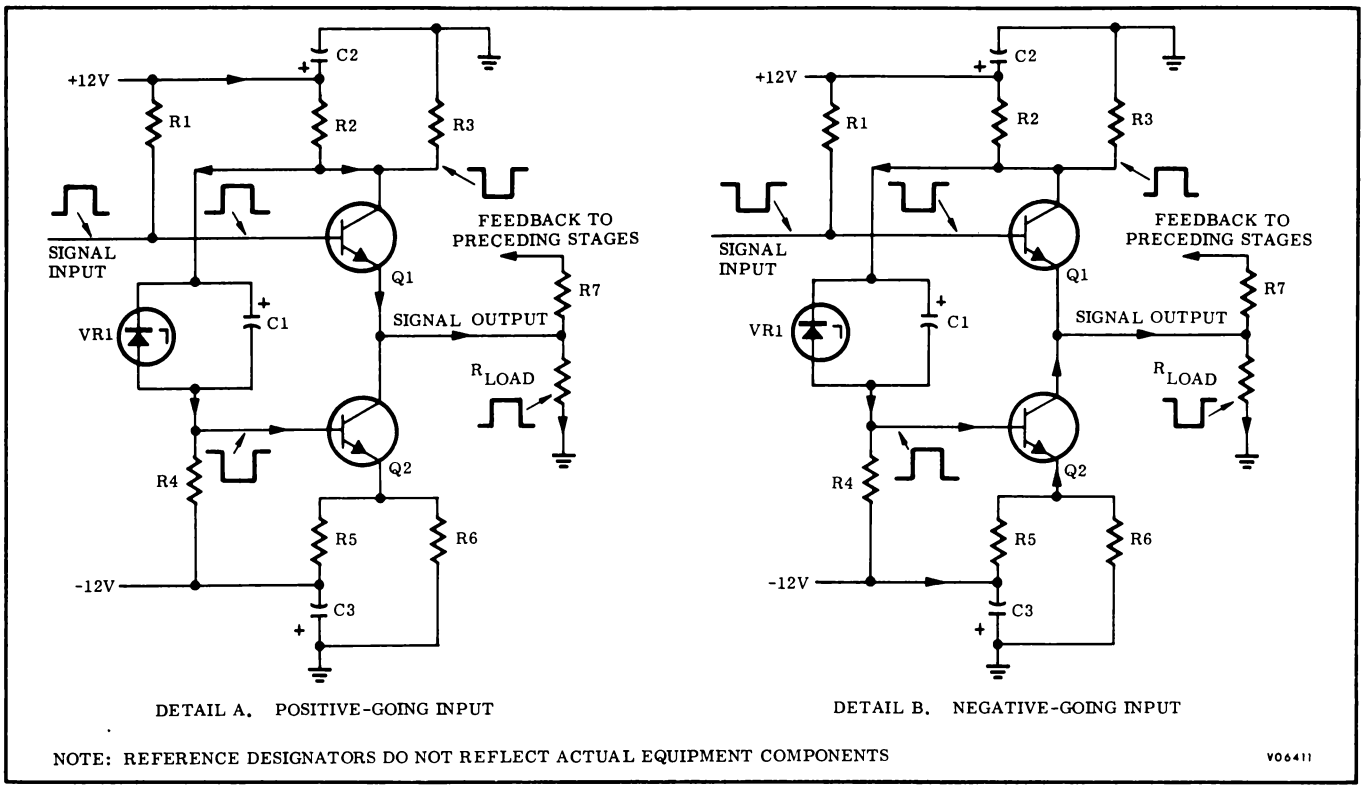


Figure 5-5. Single-Ended Push-Pull Amplifier Simplified Block Diagram

to ground (see Detail A, Figure 5-5). As more current is drawn through R2, the voltage drop across it will increase. The resulting less-positive voltage at the junction of R2 and R3 will be coupled through the network composed of C1 and VR1 to the base of Q2, reducing the current through Q2. (A zener diode and a capacitor are used to pass all frequencies from dc upward, yet maintain the proper bias for Q2.)

5-28 A negative-going input signal will turn Q1 off, reducing the current through R2; the resulting more-positive voltage at the junction of R2 and R3 will be coupled through the network and drive Q2 into heavier conduction. Current proportional to the base voltage will be passed by Q2 from the negative 12-volt supply through R5 and the load resistor to ground (see Detail B, Figure 5-5).

5-29 The output of the single-ended push-pull amplifier is fed through R27 to pin 4 of J002 (video to the afc accessory), through a 12-dB pad to pin 5 (input monitor). The entire feedback amplifier has a gain of 4, and the 12-dB pad will reduce the pin 5 output (when terminated in 75 ohms) to the same level as the video input. Part of the amplifier output is also returned as degenerative feedback to the differential amplifier Q7, Q8.

5-30 DC RESTORER. The amplifier output is also fed through the video gain control R16 to emitter follower Q1. The output of Q1 is coupled through C7 to a dc restorer composed of CR3 and CR4. If the signal system is not equipped with an afc accessory, the sync tips of the composite video signal are held at approximately ground potential by the dc restorer. If the afc is used, the blanking level is clamped to ground potential during back porch time.

5-31 Emitter followers Q2 and Q3 are cascaded at the output of the dc restorer; this allows the dc restorer to work into a high impedance while the output to the pre-emphasis network through pin 7 of J002 is 75 ohms.

The pre-emphasis circuitry is described in paragraph 5-12.

5-32 FREQUENCY CONTROL. The pre-emphasized video signal is brought in through pin 12 of J002 to a grounded-base amplifier Q9. A small amount of direct current is applied to Q9 through pin 13 from the frequency-control resistors in the standards selector (refer to paragraph 5-12); this current will shift the dc level of the video at the collector of Q9 to the level required for the proper carrier frequency for any given video standard (refer to Table 5-2 and Table 5-3).

5-33 MULTIVIBRATOR. The output of Q9 is fed through cascaded emitter followers Q10 and Q11 to the voltage-controlled multivibrator composed of Q12 through Q17. Q14 and Q15 form the basic multivibrator; Q16 and Q17 reduce capacitance at the collectors of Q14 and Q15 and supply a low-impedance, high-current discharging path for capacitors C20 and C21. Q12 and Q13 provide a constant-current charging source for C20 and C21.

5-34 The charging current for C20 and C21 is modulated by varying the current supplied to the emitters of Q12 and Q13 (which are in a grounded-base configuration), thus providing a highly linear control of frequency. The symmetry of the multivibrator is set at the factory by adjusting the balance control R56 for equal charging rate of the two capacitors; second harmonic content will be at a minimum in the output signal, and the video signal will be completely balanced out in the differential output amplifier Q18, Q19.

5-35 R55 is a factory-set adjustment controlling the sensitivity of the modulator, and is adjusted so that the frequency control current from the video standards selector will properly control the modulator carrier. The modulator VIDEO GAIN control sets deviation, and will normally be left in the UNITY position; the standards selector will maintain a constant deviation ratio for any video standard.

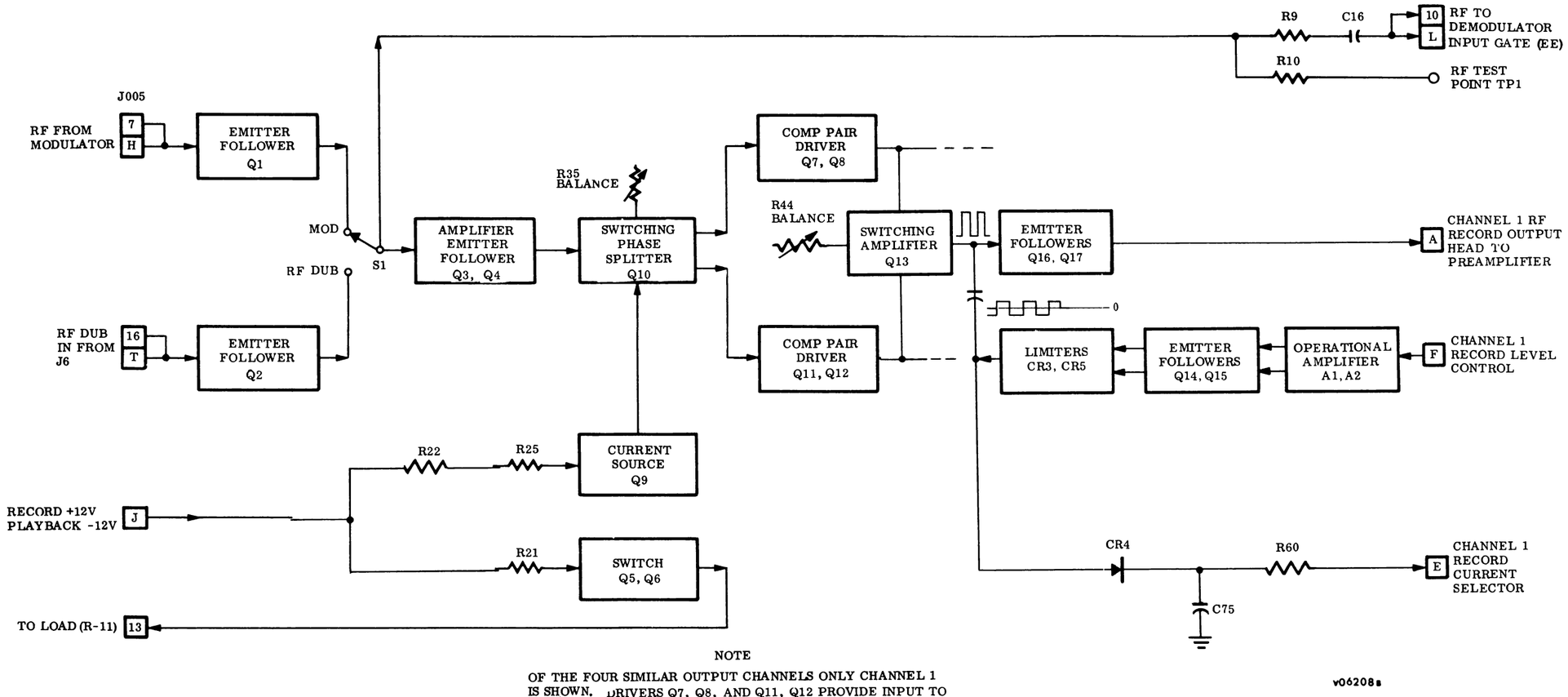
5-36 R58 is user-adjustable through a hole in the front panel of the modulator (item 25, Figure 3-5). R58 sets the total charging current of the timing capacitors, C20 and C21, and is used to adjust the carrier frequency. Refer to Section VIII for calibration instructions.

5-37 When the multivibrator is in operation, one of the transistors will be turned off. If Q15 is turned on, Q14 will be off; the collector of Q14 will rapidly approach the level of the positive 12-volt power supply due to the current through R47, but will be held at positive 4 volts by CR8. Q13 will charge C21 until Q14 turns on; at this point Q15 will turn off, and the process will repeat with Q15.

5-38 Temperature Compensation. All semiconductor junctions in the multivibrator are arranged so that another semiconductor junction will provide temperature compensation. Temperature compensation for the positive 6.2-volt regulator is also provided in the base circuit of Q20.

5-39 Starting Oscillator. As the multivibrator is extremely well balanced, there is a chance that Q14 and Q15 might both turn on when power is first applied to the modulator, and no oscillation will occur. If this happens, however, no current will be drawn through CR7 and CR8 from the positive 4-volt regulator, Q24. The voltage at the collector of Q24 will become more positive, and Q23 will be turned on. Q23, in turn, will turn on a unijunction relaxation oscillator, Q21; the signal from Q21 will be amplified by Q22 and used to turn on CR12 and unbalance the multivibrator long enough to start oscillation. When current is again drawn from Q24, the starting oscillator will turn off.

5-40 MODULATOR OUTPUT. The opposite-phase signals from emitter followers Q16 and Q17 are limited by CR9 and CR10 to approximately 1.4 volts (peak-to-peak) and coupled to a differential amplifier composed of Q18 and Q19. The signals are combined



NOTE

OF THE FOUR SIMILAR OUTPUT CHANNELS ONLY CHANNEL 1 IS SHOWN. DRIVERS Q7, Q8, AND Q11, Q12 PROVIDE INPUT TO ALL FOUR SWITCHING AMPLIFIERS

Figure 5-6. Record Amplifier Functional Block Diagram

in the differential amplifier and coupled through pin 18 of J002 to the record amplifier and the afc accessory, if the system is so equipped. (This output is approximately 0.7 volt peak-to-peak when terminated in 75 ohms.)

5-41 Record Amplifier (Module 5)

5-42 The record amplifier accepts rf from the modulator or from an external source (another video recorder), amplifies and feeds the rf to each of the four video heads in the Mark Ten Head Assembly. The record amplifier includes circuitry for controlling the recording level of each head and for monitoring the recording current of each head. Figure 5-6 is a block diagram of the record amplifier

5-43 INPUT SELECTION. Squarewave rf signals from the modulator are routed through pins 7 and 8 of module connector J005 and from an external source through pins 16 and T. The two signals are coupled to identical emitter-followers, Q1 and Q2; the source to be used is selected by the front panel MOD-RF DUB switch. High isolation between sources is achieved by grounding whichever signal is not selected.

5-44 Figure 5-7 shows a simplified schematic diagram of the type of high-isolation switch used in the record amplifier. When signal 1 has been selected, the emitter of Q1 and the anode of CR1 will be approximately 0.7 volt negative due to the voltage-divider configuration of R1 and R3; Q1 will be biased on and CR1 will be biased off. Q1 will function as a normal emitter-follower, coupling signal 1 through S1 to the next stage.

5-45 Signal 2 has not been selected, therefore the junction of the emitter of Q2 and the anode of CR2 will be approximately 0.7 volt positive (The voltage of the forward voltage drop across a conducting silicon diode); current is supplied from the positive 12-volt supply through R2 and CR2 to ground. Q2 will be biased off, and CR2 will conduct. Any signal that might leak through Q2 (due to capacitive or other coupling effects) will be shunted to ground by CR2.

5-46 The signal that has not been selected therefore will be coupled into an open circuit (Q2), a short circuit to ground (CR2), another open circuit (S1), and finally another low impedance to ground (the input impedance of the following stage). Crosstalk in this type of circuit is at a minimum.

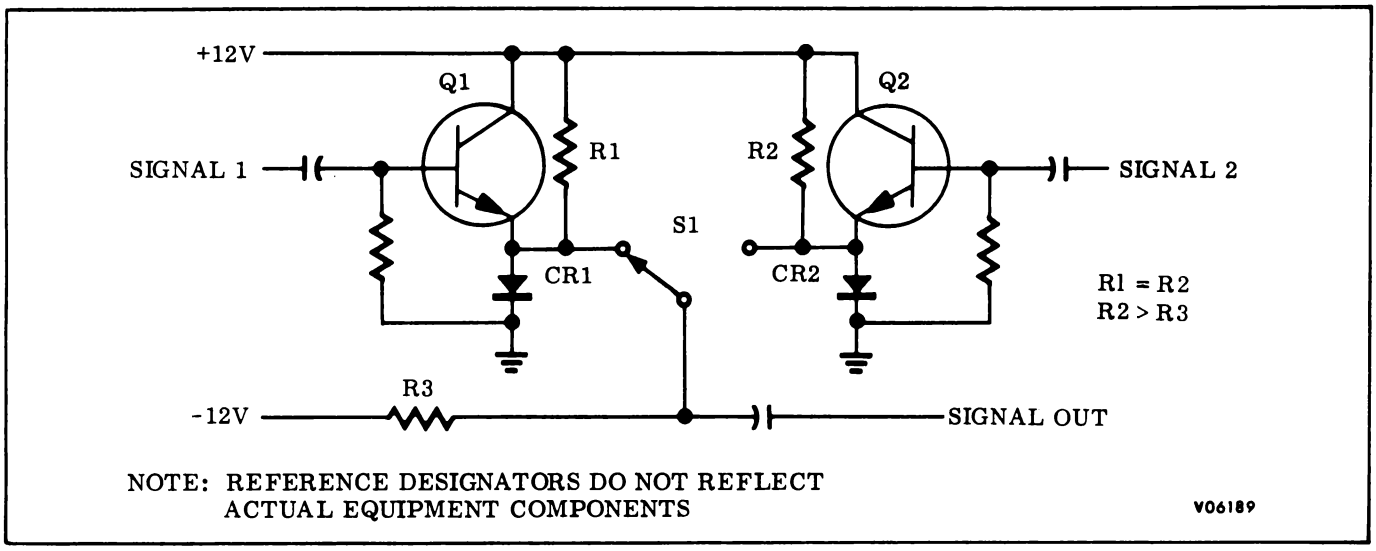


Figure 5-7. High-Isolation Switch Simplified Block Diagram

5-47 SIGNAL DISTRIBUTION. In the record amplifier, the selected rf signal is amplified by Q3 and coupled to emitter-follower Q4. The same signal from the common terminal of S1 is coupled through R23 and C19 to pins 10 and L of the module connector; this output is routed to the drop-out sensor and demodulator input gate and selected when the system is in the e-e mode. This signal is also coupled through R17 to the RF test point (TP1) on the front panel of the record amplifier.

5-48 SWITCHING AND OUTPUT STAGES. The output of emitter-follower Q4 is coupled to the switching phase-splitter composed of Q10. Q9 serves as a current source for the switching phase-splitter, and activates this circuit only when positive 12 volts is present at pin J of J005. In the playback mode of the tape system (negative 12 volts on pin J), Q9 will not conduct but the switch composed of Q5 and Q6 will be turned on. The switch places a load roughly equivalent to the record electronics across the power supply in order to maintain a constant load on the supply.

5-49 The switching phase-splitter Q10 couples the one phase of the rf squarewave to a pair of complementary emitter followers Q7, Q8. The other phase is coupled to a similar complementary pair Q11, Q12. Resistor R35 in the switching phase splitter is a factory-set symmetry control used to balance out second harmonic content which might be generated by the switching action.

5-50 Each pair of drivers provides positive and negative inputs to the switching amplifiers for all four head channels; as the four channels are identical, only channel 1 will be described.

5-51 Q13 in the switching amplifier is driven into conduction by the positive output of driver Q7, Q8; Q3 supplies a negative-going output to transformer T1. When Q13b is driven into conduction (180 degrees later) by the signal from driver Q11, Q12, it provides a positive-going output to T1. The signals are combined in the primary of T1; R44 is a factory-set symmetry control used to balance out second harmonic content which might be generated by the switching action.

5-52 The secondary of T1 feeds the signal to a pair of complementary emitter-followers Q6, Q7 which provide the 50-ohm rf output to the rotary head through the head connector and head preamplifier assemblies. Limiting of the signal amplitude is controlled by CR3 and CR5; the amount of limiting is determined by the amount the bias voltage of CR3 and CR5 is varied, which is determined by emitter-followers Q14, Q15, and operational amplifiers A1, A2. Part of the output signal is rectified by CR4 and filtered by C150 to drive the RECORD CURRENT meter.

5-53 The output signal of the record amplifier is an rf squarewave similar to the output of the modulator but of considerably higher amplitude, and divided to drive the four video heads in the head assembly.

5-54 Head Preamplifier

5-55 The head preamplifier module is part of the Mark Ten Head Assembly, and is linked to the signal system through head connector assembly 1240129. Figure 5-8 is a functional block diagram of the head preamplifier module, including appropriate portions of the head connector assembly. As the four head channels are identical, only channel 1 is shown and described.

5-56 Rf input from the record amplifier is fed from the signal system through J5 of the head connector and pin 25 of the mated module connector to transformer T1. T1 is an auto-transformer and couples rf to the primary of the channel 1 rotary transformer. R1, C1, and L1 combine with T1 to form an equalizing network which slopes the squarewave voltage input from the record amplifier to the proper shape to drive a squarewave current through the head.

5-57 Relay K1 is activated by the system record bus and the video head optimizer

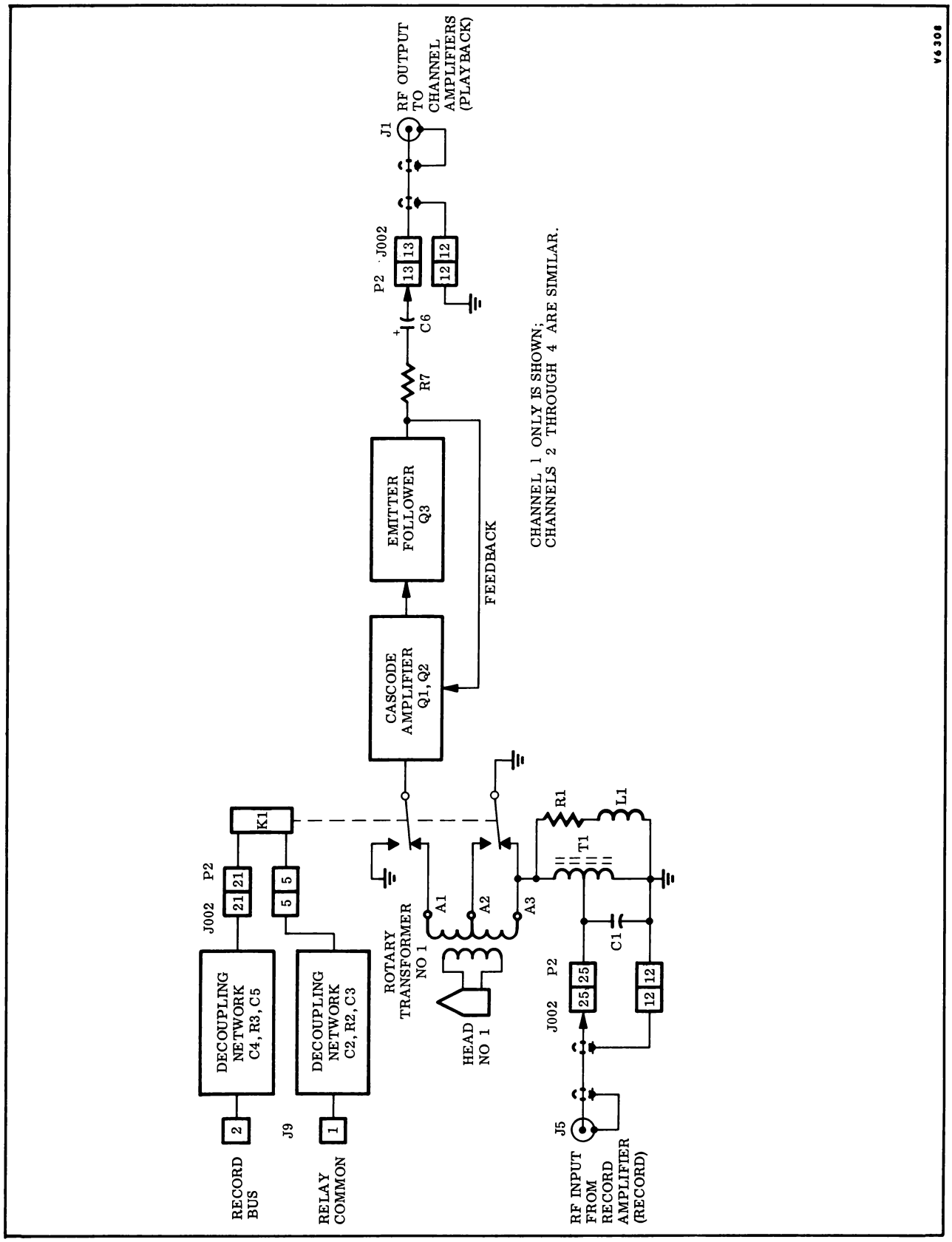


Figure 5-8. Head Preamplifier Functional Block Diagram

accessory through two decoupling networks; these are necessary to ensure that the dc lines to the head connector assembly remain free of rf.

5-58 Figure 5-8 shows K1 de-activated; when K1 is activiated, pin A2 of the rotary transformer is grounded (note that the primary of the rotary transformer is stationary; no sliding contacts or other commutating devices are used in the Mark Ten Head Assembly) and rf appears only between A3 and A2 of the primary. The secondary of the rotary transformer is connected to head number 1 on the rotating video head drum. Each pass of this head across the tape will record approximately 17 lines of video (525-line standards).

5-59 PLAYBACK MODE DETAILED THEORY

5-60 Head Preamplifier

5-61 In playback mode K1 is not energized; pin A3 of transformer T1 is grounded, and the rf induced into T1 from the video head is taken from pin A1 and coupled to the cascode amplifier composed of Q1 and Q2 (see Figure 5-8). The output of the cascode amplifier is fed through emitter follower Q3, and R7 and C6 through pin 13 of the mated connectors to coaxial connector J1. Channel 1 rf output to the channel amplifier module is taken from J1.

5-62 Degenerative feedback is coupled from the output of Q3 back to the cascode amplifier to maintain stability and lower the input impedance of Q1 to approximately 160 ohms; the low input impedance will reduce the Q of the resonant head circuits to 0.1 or less, and keep the response uniform and independent of the characteristics of a particular head.

5-63 Channel Amplifier (Module 6)

5-64 The channel amplifier accepts preamplified playback rf from the four head channels and amplifies it to the proper level for operation of the rf switcher and equalizer. As all four channels are electrically identical, only the operation of channel 1 is described and is shown in block diagram Figure 5-9.

5-65 Rf input from the head connector assembly through J1 and pin 1 of J006 is coupled to a feedback amplifier composed of Q5 and Q6. The feedback ratio is selected to make the input impedance 50 ohms. The output of the feedback amplifier is coupled

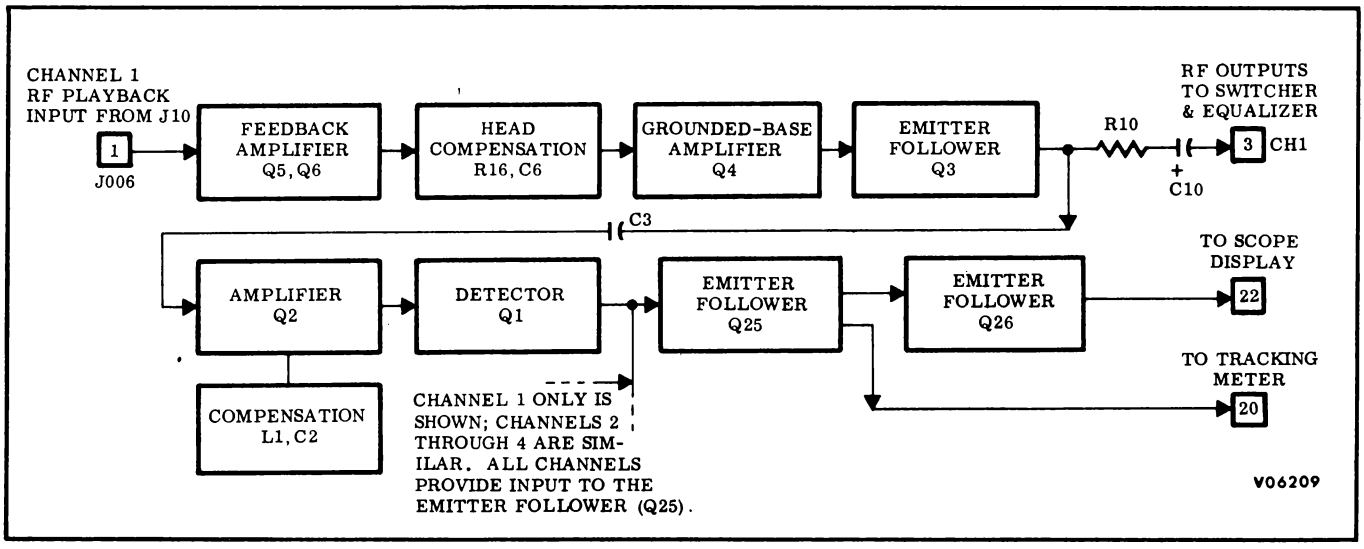


Figure 5-9. Channel Amplifier Functional Block Diagram

through a head compensation network, R16 and C6, to grounded-base amplifier Q4.

5-66 The head compensation network provides an upward slope of six decibels per octave to compensate for the response of an inductive head working into the low input impedance of the head preamplifier. R16 stops the slope at low frequencies where the reactance of the head is low with respect to the input impedance of the head preamplifier.

5-67 The output of Q4 is coupled through emitter follower Q3 and an output network composed of R10 and C10 to pin 3 of J006 where it is routed to the channel 1 input of the rf switcher and equalizer module.

5-68 The output of Q3 is also coupled through amplifier Q2 with further frequency compensation in the form of L1 and C2 to detector Q1. The detector output is coupled through emitter follower Q25 to pin 20 of J006, where it is routed to the TRACKING meter. The detectors for all four head channels terminate at the input to emitter-follower Q25; the output of all four heads is therefore integrated and measured simultaneously.

5-69 The output of Q25 is also fed through emitter-follower Q26 to pin 22 of J006, where it is routed to the selector switch of the waveform monitor (if the system is so equipped).

5-70 RF Switcher and Equalizer (Module 7)

5-71 RF SWITCH. The rf switch functions to combine the signals from the four video head channels to form a continuous train of reproduced information. Figure 5-10 shows a representation of the rotary head drum (Mark Ten Head Assembly) as viewed from the right-hand end of the head assembly. Head number two is at the midpoint of its travel across the tape; head number three will start its travel across the tape as head number two is leaving the tape. At that point, the signal system will cease receiving rf from head number two and begin to receive rf from head number three.

5-72 There are two switching operations in the rf switcher; the first takes place in a 4:2 switch, or slow switch, which is driven by the 240-Hz (250-Hz for 50-field standards) tach waveforms from the switcher logic module. The slow switch has two outputs: one output contains combined rf from head number one (channel 1) and head number two (channel 2); the other output contains combined rf from head number four (channel 4) and head number three (channel 3). See Figure 5-10 and block diagram Figure 5-11.

5-73 The emitters of Q14 (channel 1 gate) and Q15 (channel 2 gate) in the slow switch are connected together and to pin 14 of J007, which receives the tach waveform from module 8. The emitters of Q19 (channel 3 gate) and Q20 (channel 4 gate) are connected together and to pin 15 of J007, which receives the tach plus 90-degree waveform from module 8.

5-74 The bases of Q14 and Q20 (both npn) are biased slightly positive; the bases of Q15 and Q19 (both pnp) are biased slightly negative (referenced to chassis ground). By making the emitter of Q14 negative with respect to its base (during the negative portion of the tach waveform), Q14 conducts and passes channel 1 rf to the fast switch. When the tach waveform is positive, the emitters of both Q14 and Q15 are positive with respect to their bases; Q14 turns off and Q15 conducts, passing channel 2 rf to the fast switch.

5-75 Q19 and Q20 respond in a like manner to the tach plus 90-degree waveform; the positive phase turns on Q19, which passes channel 3 rf, and the negative phase turns on Q20, which passes channel 4 rf.

5-76 The outputs of the slow switch are coupled to a 2:1 switch, or fast switch, which is driven by 480-Hz (500-Hz for 625-line standards) gating pulses from the switcher logic module. The output of the fast switch contains rf from all four head channels.

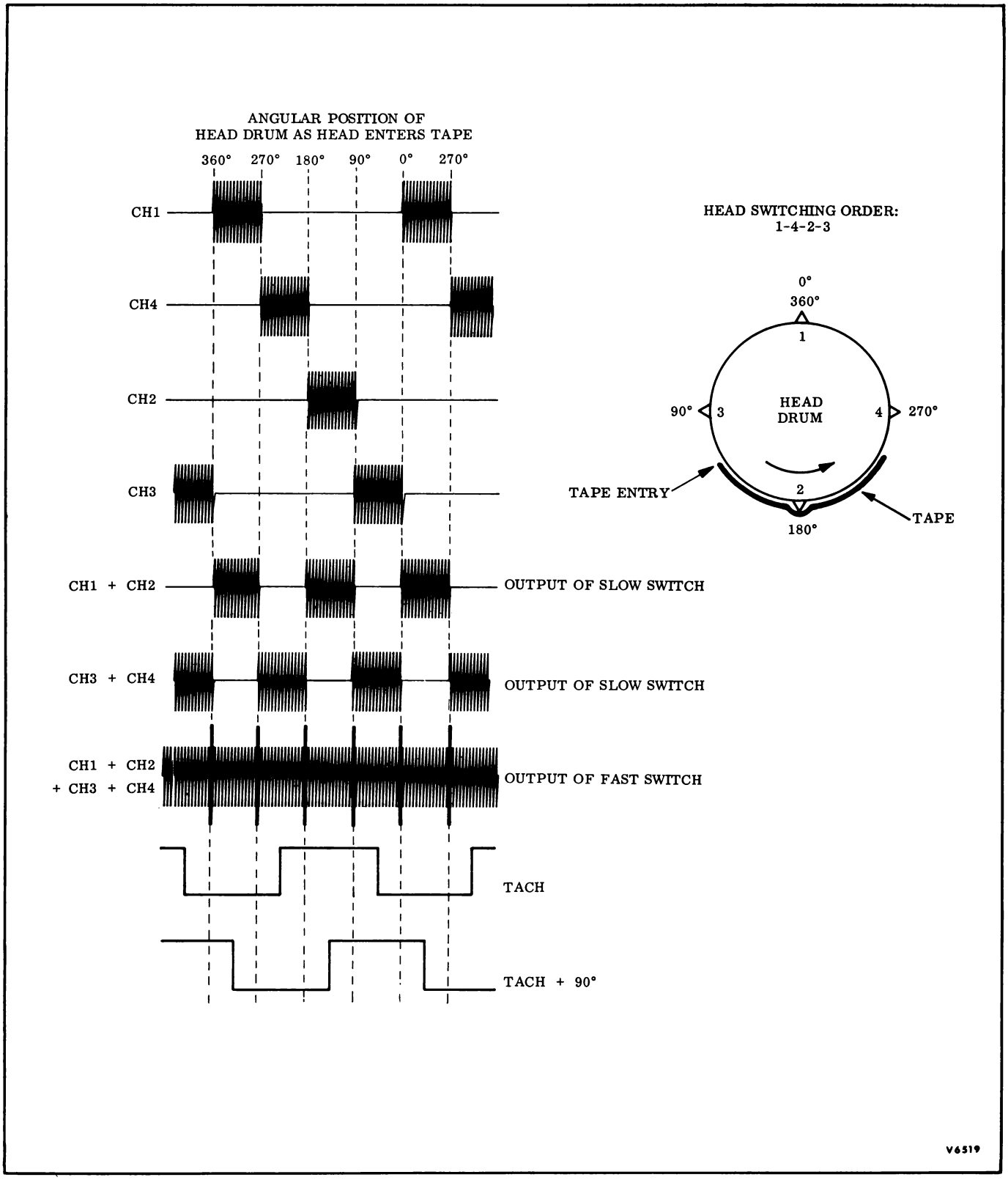
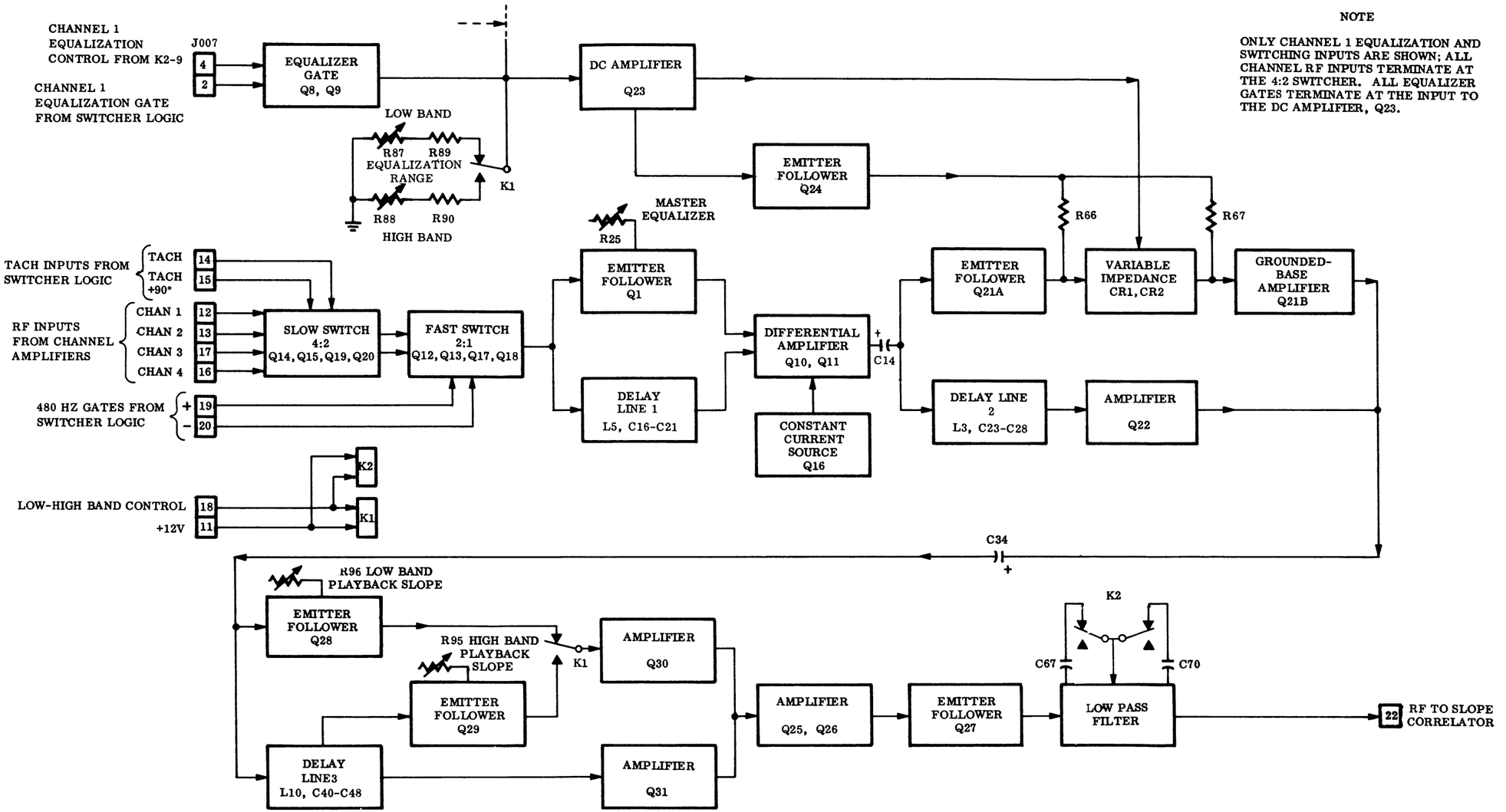


Figure 5-10. RF Switch Function



NOTE

ONLY CHANNEL 1 EQUALIZATION AND SWITCHING INPUTS ARE SHOWN; ALL CHANNEL RF INPUTS TERMINATE AT THE 4:2 SWITCHER. ALL EQUALIZER GATES TERMINATE AT THE INPUT TO THE DC AMPLIFIER, Q23.

Figure 5-11. RF Switcher and Equalizer Functional Block Diagram

5-77 It is not strictly true, as stated in paragraph 5-71, that head number three enters the tape as head number two is leaving. Although the heads are mounted exactly 90 degrees apart, each head traverses a total of 120 degrees of arc across the tape. Most of this excess is later removed by subsequent erasure in the audio and cue head assembly. However, there will be a short period when both heads are playing back the same information (all four video heads carry the same information in record). Switching from one head to the next in the signal system takes place during this period. Consequently, when the outputs from all four head channels are added in the fast switch, there will be short intervals of overlap in the fast switch output.

5-78 Head switching, however, always takes place on the first front porch after the head enters the tape. Clamping the composite video signal to blanking level during this time eliminates both the additive transients and head-switching transients (caused by phase discontinuities in the fm carrier when switching from one head to the next). This action takes place in the output video module after demodulation and filtering, and just before playback pre-emphasis (refer to paragraph 5-126).

5-79 PLAYBACK EQUALIZATION. The description of the playback equalization circuitry includes range switching, overall (master) playback equalization, and individual channel playback equalization.

5-80 Range Switching. When the video standards selector (S1) is placed in the 525 HIGH BAND or 625 HIGH BAND position, negative 12 volts from S1-J is brought into the rf switcher and equalizer through pin 18 of J007; the 24 volts between pins 18 and 11 is used to activate relays K1 and K2. K1 selects the low or high-band equalization range and playback slope; K2 adjusts the low-pass filter and the module output for low or high-band characteristics. Figure 5-11 shows both relays de-activated; the signal system in this case is set to the 525 MONO, 525 COLOR or 625 LOW BAND position.

5-81 Master Equalizer. Delay line 1 and emitter follower Q1, both at the output of the fast switch, provide cosine equalization of frequency response in playback. The delay line is terminated in its characteristic impedance at the input end, and unterminated at the output end. Therefore the output end "sees" only the input signal, and the input end "sees" the input signal plus the reflection (or standing waves) from the unterminated output. The delay produced by the delay line causes the reflection to appear at some time later than the original signal. The input signal to Q1, which includes this delay, changes amplitude as a function of frequency (cosine curve).

5-82 Q10 and Q11 form a differential amplifier; Q11 receives input from the delay line, and Q10 receives input from emitter-follower Q1. Output to the next stage is taken from the collector of Q10; emitter current for both Q10 and Q11 is supplied at a constant rate by Q16. Consequently, the current drawn by one amplifier tends to decrease the current available for the other amplifier; the ratio of amplification between the two is set by R25, which controls the output level of Q1. Q10 and Q11 will amplify and pass the difference between the cosine output of Q1 and the delay line output.

5-83 This type of equalization permits constant delay at the video frequencies of interest; original phase relationships among the reproduced video components are not altered or distorted.

5-84 Individual Channel Equalization. Four equalization input gates are employed in the rf switcher and equalizer to provide playback equalization of each head channel; as the four gates are similar, only the channel 1 gate is shown in Figure 5-11 and described in the text.

5-85 Equalization control voltage from relay K2 on the signal system chassis is brought in through pin 4 of J007; this control voltage, when K2 is in its normally open condition, is taken from the wiper of R1 on the signal system control panel (CH1 PLAYBACK

EQUALIZATION). If the Auto-Chroma accessory is used, K2 will energize and equalization control voltage will be taken from the Auto-Chroma 2 module (module 15). In either case, the control voltage will have the same range, approximately 6 to 11 volts negative referenced to the signal system chassis.

5-86 During the time that the output of the fast switch consists of channel 1 rf, energizing voltage for equalizer gate Q8 is fed through pin 2 of J007 from the switcher logic module. The range of equalization control at the output of the equalizer gate is limited by R87 (low-band standards) or R88 (high-band standards).

5-87 By feeding a current proportional to the control voltage to the junction of the CR1 and CR2 cathodes, amplifier Q23 controls the impedance between the output of Q21A and the input of Q21B in response to the equalization control voltage from the equalizer gate. A current of the opposite polarity from that at the junction of CR1 and CR2 is coupled through Q24 to the anodes of CR1 and CR2 to balance out the control signal from the input to Q21B. The variable impedance circuitry may be considered a remotely-controlled electronic potentiometer, set at a different value during the time that any particular head channel is playing back.

5-88 Rf from Q10 is coupled through C14 to delay line 2 and emitter-follower Q21A; Q21A passes the rf from Q10 plus the reflected rf from the unterminated delay line (refer to paragraph 5-81). The output level of Q21A is passed through CR1 and CR2 to amplifier Q21B. After amplification by Q22, delayed rf is added to the rf from Q21B.

5-89 Playback Slope Range Switching. For low-band video standards, rf from C34 is coupled through delay line 3 and amplified by Q31. The same signal, plus reflected rf from the unterminated delay line is coupled through emitter-follower Q28 and level control R96 to amplifier Q30. The outputs of Q30 and Q31 are added and coupled to the cascode amplifier formed by Q25 and Q26.

5-90 In either of the high-band standards, rf from C34 is fed through delay line 3 to amplifier Q21. Delay line 3 is tapped at approximately 33 percent; partially delayed rf plus reflected rf from the unterminated delay line is coupled through emitter follower Q29 and level control R95 to amplifier Q30. The two amplifier outputs are added and amplified by Q25 and Q26. The output of Q26 is fed through emitter-follower Q27 and a low-pass filter to pin 22 of J007.

5-91 Switcher Logic (Module 8)

5-92 The switcher logic module controls head channel switching and equalization gate switching in the rf switcher and equalizer module by integrating head position information from the head drum tachometer (Mark Ten Head Assembly) and horizontal timing information from the sync processing module.

5-93 Switcher logic operation is automatically switched from 525 to 625-line standards whenever the signal system video standards selector is placed in the 625 LOW BAND or 625 HIGH BAND position. Descriptions of switcher logic operation are based upon 525-line operation; conversion information is given in Table 5-4.

5-94 SLOW SWITCH CONTROL OUTPUTS. A nominally 240-Hz squarewave from the Intersync servo system, representing the rotational position of the video head drum, is brought into the switcher logic module through pin 6 of J008 and coupled to complementary emitter-follower Q5, Q6 (see Figure 5-12). This circuitry has four outputs; two are used in the slow switch control circuitry, and the other two are used in a phase-locked loop within the switcher logic module (refer to paragraph 5-100).

5-95 One output of Q5, Q6 is differentiated by C9 to form a series of short pulses at a pulse-repetition frequency (prf) of 240 Hz. This is applied as the input to monostable multivibrator Q7, Q8, the tach slow

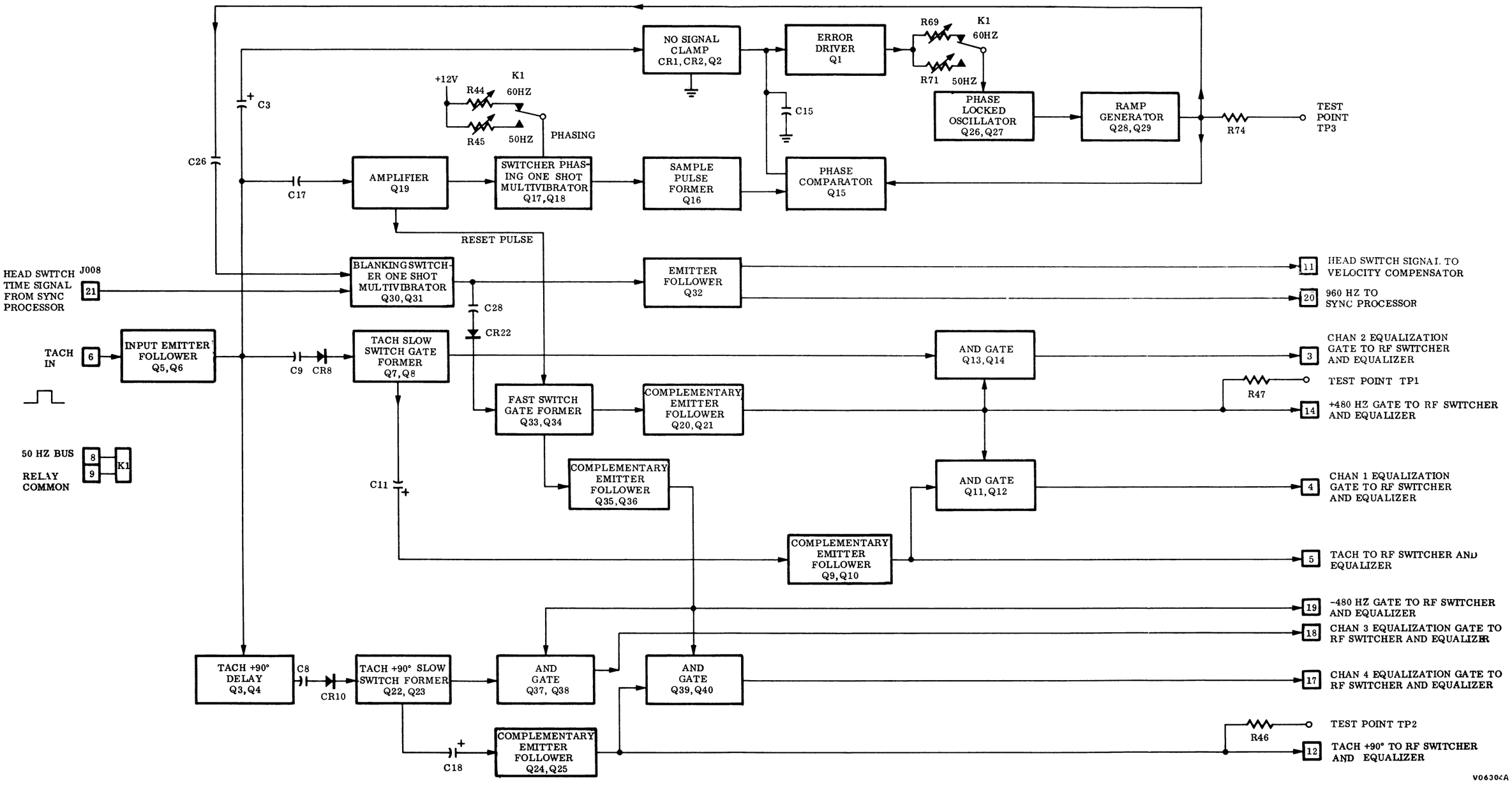


Figure 5-12. Switcher Logic Functional Block Diagram

Table 5-4. Timing Cross Reference

CHARACTERISTIC	525-LINE STANDARDS		625-LINE STANDARDS	UNITS
	MONO	COLOR		
Power line frequency	60	60	50	Hz
Vertical rate	60	59.94	50	fields/sec
Frame rate	30	29.97	25	frames/sec
Horizontal rate (sync)	15,750	15,734.3	15,625	pps
Head drum motor speed	14,400 240	14,400 240	15,000 250	rpm rps
Tachometer rate	240	240	250	Hz
Outputs to module 7 slow switch	240 240	240 240	250 250	Hz Hz (90-degree delay)
Outputs to module 7 fast switch	480 480	480 480	500 500	Hz Hz (180-degree delay)
Outputs to module 12 and velocity compensator accessory	960	960	1000	Hz (leading edge coincident with head switch timing)
Output to module 7 equalization gates	1.04 240	1.04 240	1.00 250	msec pulse Hz prf

switch gate former, which is triggered by these pulses to produce a 240 Hz squarewave. This squarewave signal is coupled through C11 to emitter-followers Q9 and Q10. An inverted 240-Hz squarewave is fed to AND gate Q13, Q14 (channel 2).

5-96 The output of Q9, Q10 is fed to AND gate Q11, Q12 (channel 1) and also to pin 5 of J008 where it is routed to the tach input of the module 7 slow switch.

5-97 The second output of Q5, Q6 is fed to the 90-degree delay circuitry of Q3 and Q4. The 240-Hz squarewave input triggers Q3 and Q4 to produce a train of one millisecond pulses at a prf of 240 Hz. The pulses are differentiated by C8, and fed to the tach plus 90 degree slow switch former. The 240 Hz squarewave output of Q22, Q23 is coupled through C18 to emitter-followers Q24 and Q25. An inverted 240-Hz squarewave is fed to AND gate Q37, Q38 (channel 3).

5-98 The output of Q24, Q25 is fed to AND gate Q39, Q40 (channel 4) and also to pin 12 of J008, where it is routed to the tach plus 90 degree input of the module 7 slow switch.

5-99 The function of the AND gates is described in paragraph 5-110.

5-100 PHASE-LOCKED LOOP. Another output of Q5, Q6 is differentiated by C17 and amplified by Q19; the outputs of the amplifier pulses at a prf of 240 Hz are used to reset the fast switch gate former (refer to paragraph 5-107) and to trigger the switcher-phasing oneshot multivibrator Q17, Q18.

5-101 The period of this multivibrator is set by the tachometer phasing control R44 (60 Hz) or R45 (50 Hz). Relay K1 is activated whenever the recorder is operated with a 50-Hz reference signal, selecting the proper control. The positive-going pulse output of the multivibrator is amplified by Q16 and used to turn on phase comparator gate Q15 at a 240 sample-per-second rate.

5-102 Q15 passes a portion of the ramp waveform from Q28, Q29 to charge C15 at the input to error driver Q1. The sample is normally taken from every fourth ramp (ramp prf is 960 Hz).

5-103 The fourth output of Q5, Q6 is coupled through C3 to the no-signal clamp. The 240-Hz squarewave is rectified by voltage-doubler CR1, CR2, filtered and used to bias Q2 (npn) off; if no signal is present at the input, Q2 will turn on and connect the input of Q1 to ground. Therefore, the frequency of the 960-Hz oscillator cannot drift far enough to lengthen lock-up time appreciably.

5-104 When correction is required, Q1 functions as an emitter follower and raises or lowers the voltage through level control R69 (60 Hz) or R71 (50 Hz) - selected by K1 - to the phase-locked oscillator composed of Q26 and Q27. Normally, the dc voltage passed by Q15 is at ground potential (for zero error).

5-105 Frequency-determining voltage, including any error feedback from Q1, is connected to phase-locked oscillator Q26, Q27; the output of the oscillator is a train of negative-going pulses at a prf of 960 Hz. These pulses are fed to ramp generator Q28, Q29, where they are formed into a 960-Hz sawtooth. In addition to providing feedback output to Q15, ramp generator Q28, Q29 drives the blanking switcher.

5-106 BLANKING SWITCHER. The 960-Hz retrace pulse sawtooth from the ramp generator is differentiated by C26; the resultant pulses are fed to the blanking switcher one-shot multivibrator Q30, Q31. In order to ensure that head switching occurs only on the front porch of horizontal blanking, sync timing information from the sync processing module (through pin 21 of J008) is used to set the period of the blanking switcher.

5-107 The output of the blanking switcher is a pulse started by the 960-Hz waveform and stopped by the first front-porch pulse from the sync processor; head switching will therefore occur at the first front porch after each head enters the tape. This output is coupled through emitter-follower Q32 to pin 11 (head switching time indication to the velocity compensator accessory) and pin 20 (960-Hz trigger to the sync processing module). In addition, this output is differentiated by C28 and coupled to the fast switch gate former, binary divider Q33, Q34. The divider accepts 960-Hz pulse input, and puts out two opposite-phase 480-Hz squarewaves. A non-ambiguous reset pulse from Q19 (refer to paragraph 5-100) ensures that the divider always starts in the correct phase.

5-108 One phase of the 480-Hz squarewave is coupled through complementary emitter-follower Q20, Q21 to pin 14 of J008, where it is routed to the plus 480-Hz gate input of module 7; in addition, this signal is used to drive AND gate Q11, Q12 (channel 1) and AND gate Q13, Q14 (channel 2).

5-109 The opposite-phase output is coupled through complementary emitter-follower Q35, Q36 to pin 19 of J008; this output is the minus 480-Hz gate for the rf switcher. The minus 480-Hz output drives AND gate Q37, Q38 (channel 3) and AND gate Q39, Q40 (channel 4).

5-110 GATING CIRCUITS. All transistors in the AND gates are pnp and require a negative base drive (referenced to the emitter) to conduct. As each AND gate conducts, it biases the appropriate equalization gate in module 7 on. All four AND gates have a 240-Hz input and a 480-Hz input; a coincidence of negative inputs for each gate is necessary for conduction. Figure 5-13 illustrates the coincidence of signals required for AND gate activation, and the relationship

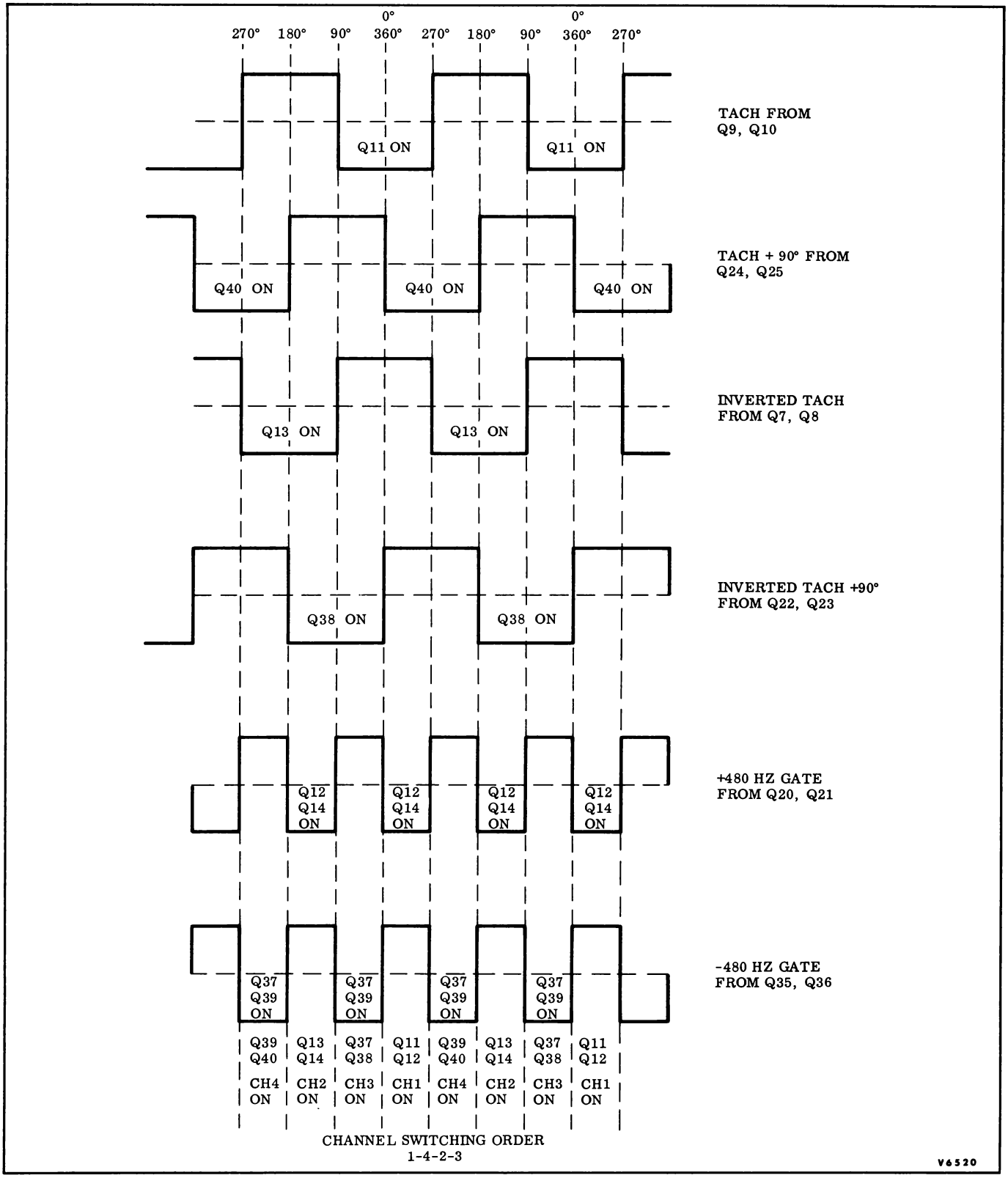


Figure 5-13. AND Gate Timing

between the channels; the channel switching order is of course the same as the head switching order in the rf switcher and equalizer.

5-111 Demodulator (Module 9)

5-112 In playback, tape rf from the rf switcher and equalizer is brought through the dropout sensor and demodulator input gate (module 13) to pin 4 of J009 and coupled to emitter-follower Q7. (See block diagram Figure 5-14.) In the electronics-to-electronics (e-e) mode, rf from the record amplifier is brought through module 13 to pin 8 and coupled to emitter-follower Q12. Q7,Q12, and K1 form a high-isolation switch which couples either playback rf or record rf to a highly linear unity gain feedback amplifier and phase splitter Q5, Q6. Refer to paragraph 5-44 for description of the operation of a high-isolation switch.

5-113 The opposite-phase outputs of the feedback amplifier and phase splitter are fed to amplifiers Q4 and Q11 which drive grounded-base amplifiers Q3 and Q10. The amplifier outputs are limited by CR3 and CR4 and fed to emitter-followers Q2 and Q9. The signals are then coupled through a series of amplifiers and limiters to amplifier Q16 and amplifier Q19. The emitters of Q16 and Q19 are coupled to differential amplifier Q17, Q20, which adds to opposite-phase signals (constant-amplitude at this point, having been passed through four stages of limiting). The output of Q17, Q20 is fed to pin 12 of J009, where it is routed to J7 and serves as the rf dub output.

5-114 The collectors of amplifiers Q16 and Q19 are coupled through a limiter composed of CR14 and CR15 to amplifiers Q21 and Q28. The outputs of Q21 and Q28 are coupled through emitter-followers Q22 and Q29 and two capacitors (C60 and the capacitances of C51 and C52 in parallel) to a tunnel-diode one-shot multivibrator.

5-115 Each zero-crossing of the square-wave input triggers the multivibrator to produce a pulse with a width of approximately 20 nanoseconds, factory-adjusted by R85.

5-116 This pulse is amplifier by Q23 and fed to emitter-follower Q25; Q23 and Q25 are supplied with regulated operating voltage from Q30. The output of Q25 is coupled to differential switcher Q26, Q27; the differential switcher is powered by constant-current source Q24.

5-117 A pulse from Q25 will drive Q27 into conduction, providing a negative-going output pulse to pin 18 of J009. At the same time, Q26 will be turned off because all the available current from Q24 will be passed through Q27. This will cause a positive-going output pulse to be coupled to pin 16 of J009.

5-118 Figure 5-15 illustrates the relationship between the rf input signal, the limited and clipped signal at the input of the one-shot multivibrator, and the constant-width constant-amplitude pulses at the output of the demodulator.

5-119 Low-Pass Filter (Module 10)

5-120 Output pulses from the demodulator are brought in through pins 1 and 14 of J010; pin 4 is an off-ground common connection (see Figure 5-16). The low-pass filter is a Bode type with the individual sections wired in a cascoded arrangement, and with an isolating network between the sections. External connections on the module receptacle (see video signal interconnect diagram in Section IX) place the eight filter sections in four connected pairs which form the lattice. The cutoff frequency of each cascode pair is slightly staggered so the ripple in one section is cancelled out by an opposite-phase ripple in the other section. Also, staggering the cutoff point increases attenuation of those frequencies falling beyond the cutoff region. The characteristic imped - ance of the low-pass filter is 150 ohms.

5-121 The low-pass filter removes all rf (carrier) components in the signal from the demodulator and integrates the demodulator

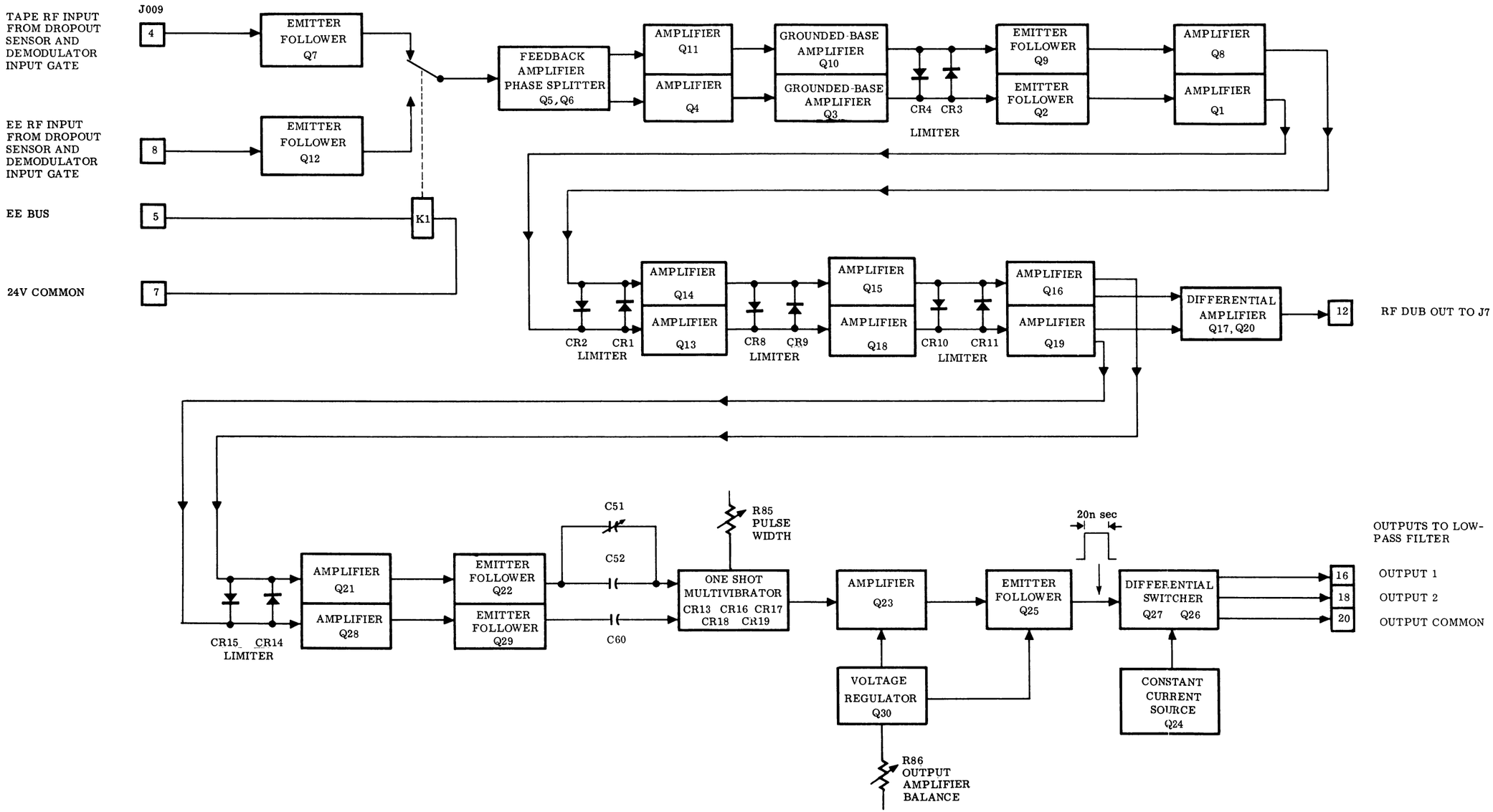


Figure 5-14. Demodulator Functional Block Diagram

pulses. The pulses from the demodulator are of equal amplitude and equal width; the only variable is the time between pulses, or the instantaneous prf.

5-122 Once the pulses have been integrated, an output will be obtained which is a very accurate representation of the pre-emphasized video signal in the modulator. The output of the low-pass filter is fed through pins 12 and 24 for balanced operation of J010 to the output video module. A second output is fed through pin 20 of the sync processing module.

5-123 Output Video (Module 11)

5-124 SIGNAL PATH. Composite video from the low-pass filter is brought in through pins 20 and 22 of J011; if the filter supplied with the signal system is used, pin 22 is input common. If one of the accessory Bode filters is used, both pins carry (opposite-polarity) vide. (See Figure 5-17).

5-125 The video signal is terminated and fed to differential amplifier Q28, Q29. The differential amplifier output is coupled through a low-pass filter composed of C38, L8, and C29 to feedback amplifier Q21, Q27. The output of the feedback amplifier is fed to emitter-follower Q22.

5-126 One output of Q22 is fed through peaking coil L6 and resistor R79 to complementary emitter-follower Q17, Q18; the other output is coupled through a low-pass filter Q19. A head-switching transient suppression pulse from the sync processing module (refer to paragraph 5-143) will turn on gate Q23 at head-switching time and ground the input to Q17, Q18.

5-127 The output of Q17, Q18 is coupled through pin 15 of J011 to the de-emphasis circuirty of the video standards selector, S1 (refer to Table 5-3). De-emphasized video from S1 is brought back into the output video module through pin 2 and coupled to grounded-base amplifier Q3. After amplification, the video signal is fed to emitter follower Q1.

5-128 The output of Q1 is passed through R103, the front-panel VIDEO GAIN control (factory-set for unity gain at the UNITY position) to a differential amplifier composed of Q4 and Q5. The differential amplifier output is coupled through emitter-follower Q2 to a single-ended push-pull amplifier composed of Q6 and Q7 (refer to paragraph 5-25).

5-129 Part of the output signal of the push-pull amplifier is returned to the differential amplifier as feedback; the other outputs are:

a. Pin 6 of J011 - Video at 75 ohms to J20 (VIDEO OUT).

b. Pin 7 of J011 - Video at 75 ohms to module 14 (Auto-Chroma accessory).

c. Pin 8 of J011 - Video at 75 ohms to J21 (OUTPUT MONITOR).

d. Video through C24 to Q16.

5-130. BACK PORCH CLAMP FEEDBACK LOOP. Q16 amplifies and inverts the video from Q6, Q7 and attenuates the high-frequency video components while preserving the sync pulse intact. This signal is coupled through emitter-follower Q15, C31, emitter-follower Q12, and emitter-follower Q13 to pin 11 of J011, where it is routed to the sync processing module.

5-131 The output of Q12 is also coupled through emitter-follower Q11, a low-pass filter, and emitter-follower Q10 to amplifier Q9. The input to Q9 is a limited waveform containing a well-defined sync pulse and almost no video information. The output of Q9 is a series of negative-going pulses at the same pulse width and pulse rate as horizontal sync.

5-132 These pulses are used to turn Q8, the clamp pulse generator, on during back porch time; the output of Q8 is a negative-going pulse which turns on clamp Q14 and gate 20. When it is turned on by this pulse, Q14 clamps the video at the input of Q12 to

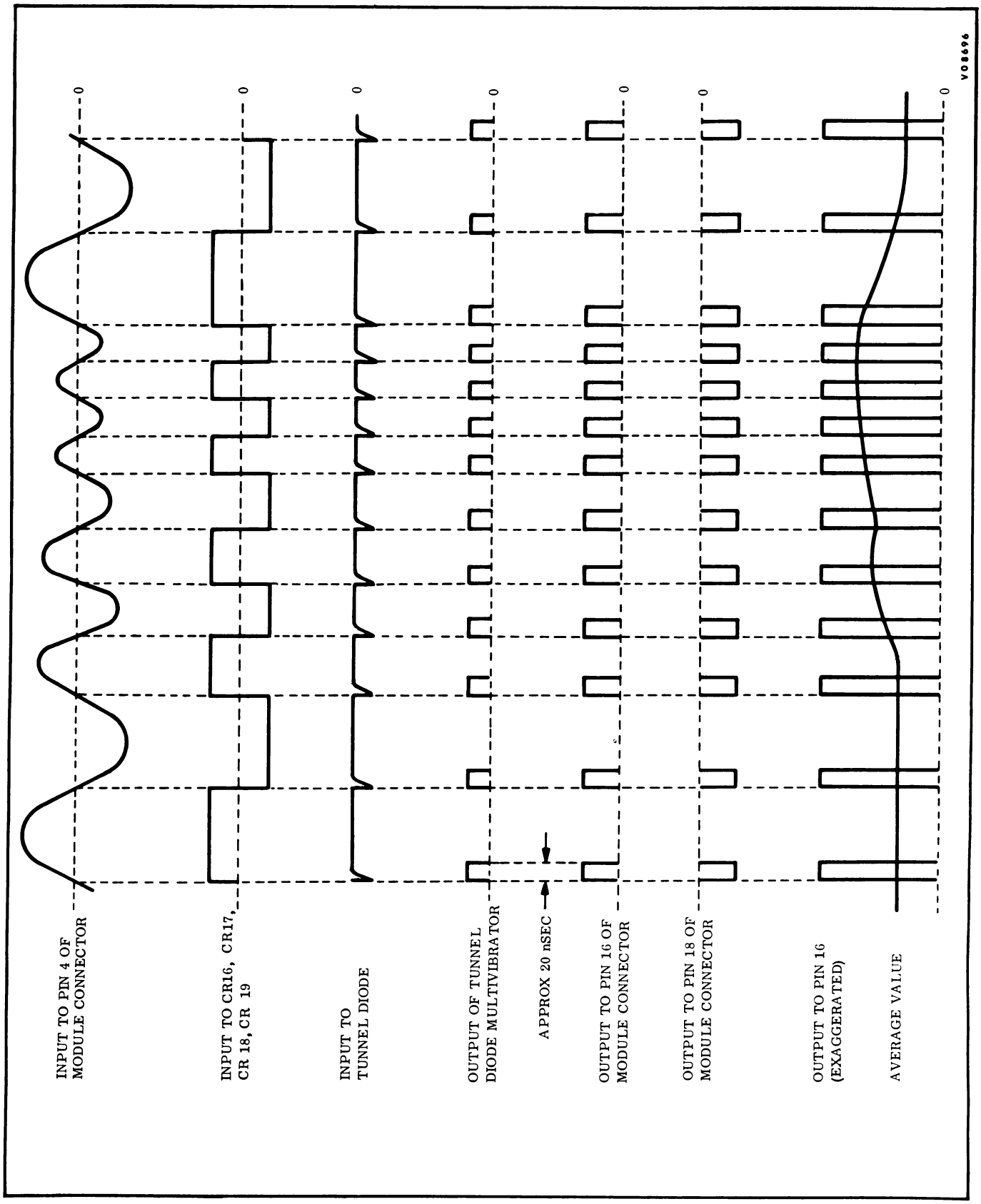


Figure 5-15. Demodulator Functions

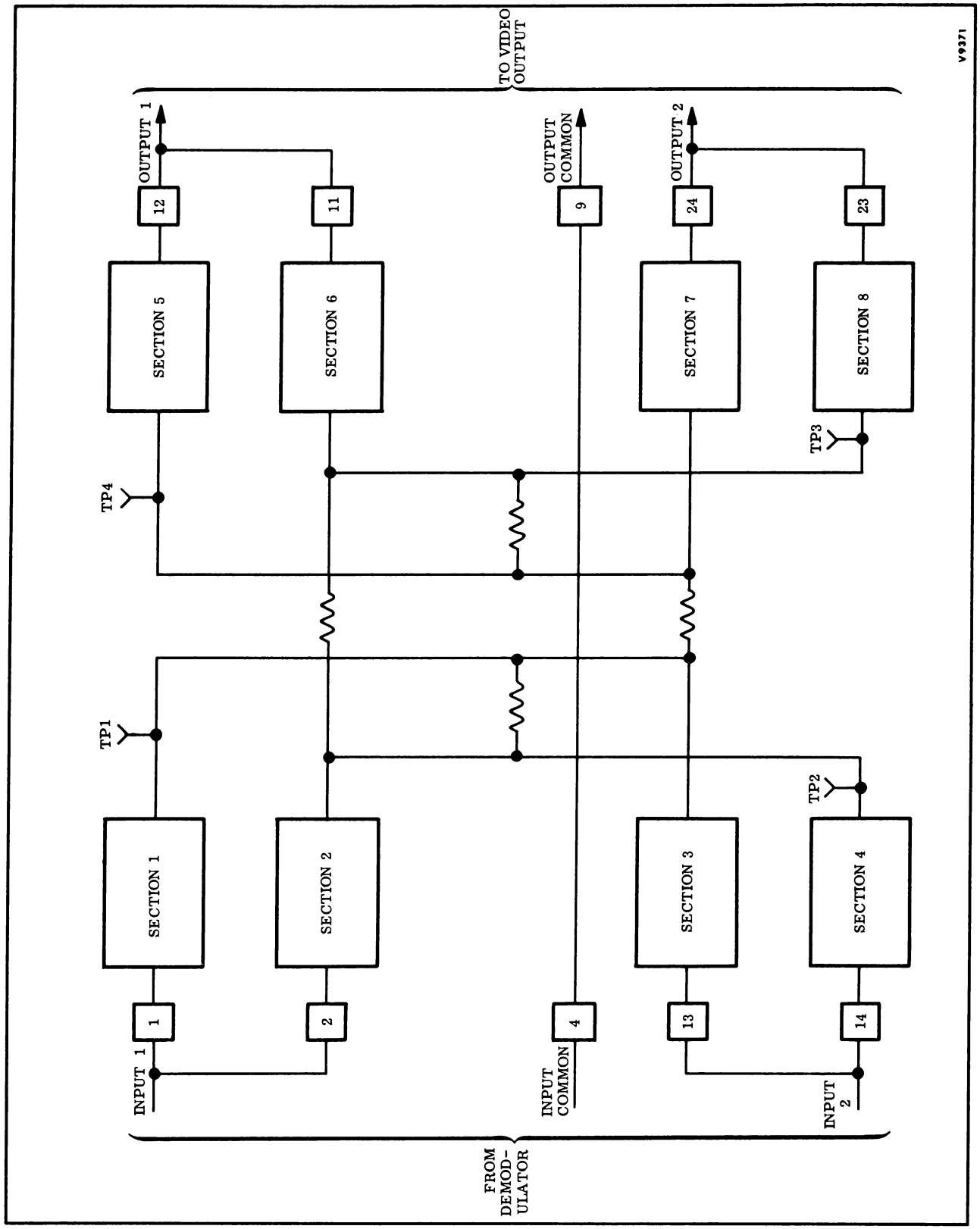


Figure 5-16. Low-Pass Filter Functional Block Diagram

ground; Q20 passes the video signal from emitter-follower Q19 to amplifier Q24, R75 in the emitter circuit of Q24 sets the dc bias level, which is returned with the video feedback through amplifiers Q25 and Q26 to differential amplifier Q28, Q29.

5-133 Sync Processing (Module 12)

5-134 HORIZONTAL TIMING ACQUISITION. Partially stripped sync from the output video module is brought into the sync processing module (sync processor) through pin 4 of J012; the signal at this point is approximately 3.5 volts peak-to-peak, with positive-going sync. Emitter-follower Q13 preserves the sync pulse but partially attenuates the video signal (see block diagram Figure 5-18).

5-135 Sync gate Q12 is initially biased on and allows the sync and remaining video to pass to the low-pass filter composed of C10, L1, and C11; the low-pass filter removes high-frequency noise and some video information. Sync amplifier Q10, Q11 clips the level of the signal and amplifies the sync pulse.

5-136 Differentiation and switching in Q9 produce a negative-going 2-microsecond pulse, the leading edge of which is coincident with the leading edge of the sync pulse. Emitter-follower Q8 passes this pulse to emitter-followers Q6 and Q7; the output of Q7 drives the sampling phase comparator gate Q35 and provides horizontal triggering pulses at 75 ohms impedance to pin 2 of J012. These pulses are coupled through coaxial connector J9 to the Intersync servo accessory of the tape system.

5-137 LOCK-UP SENSOR. The lock-up sensor circuitry drives sync gate Q12 and the guide servo enabling relay. Once horizontal lock-up is established, as described below, Q12 is driven off and passes information from Q13 only during a 5-microsecond interval when it is gated on by Q3 and Q4; the leading edge of the sync pulse is contained within this period.

5-138 Two-microsecond pulses from Q8 are coupled through R27 to emitter-follower Q6; however, Q5, which is normally biased on, clamps this signal directly to ground. Q5 is turned off by 5-microsecond pulses from Q15, and only when one of these 5 microsecond periods blankets the period of the 2-microsecond pulse from Q8 will Q6 pass a 2-microsecond pulse to detector CR5,CR6.

5-139 When a number of coincident pulses have been integrated in the detector, the output level will rise and activate Q4; Q4 then acts as a load for Q3, which functions as an amplifier for the 5-microsecond pulse from Q15. Therefore, only when Q4 is on (denoting the detected in-lock condition) will gating pulses be supplied to Q12.

5-140 In addition, the pulses from Q3 (when activated by Q4) are passed through detector CR4 and integrated at C13; this level is passed through emitter-follower Q2 and amplified by Q1. The output of Q1 is used to drive Q14, which supplies power to K1, enabling the guide-servo gate. The automatic guide servo will therefore not be allowed to move until lock-up is achieved in the signal system.

5-141 PHASE-LOCKED LOOP. Horizontal gating pulses in the sync processor are derived from the multivibrator composed of Q26, Q27, and Q28; Q27 controls the current in one leg of the emitter-coupled multivibrator comprised of Q26 and Q28, therefore controlling the period of oscillation of the multivibrator. The control voltage for Q27 is normally close to ground potential; once set by frequency control R74, the range of the multivibrator is limited by diodes CR17 and CR18; although set for zero voltage, the multivibrator will be in lock for any control voltage from 500 millivolts negative to 500 millivolts positive.

5-142 The output of the multivibrator, 9-microsecond pulses at sync rate, is coupled to emitter-follower Q29, which provides sync timing information to the switcher log-

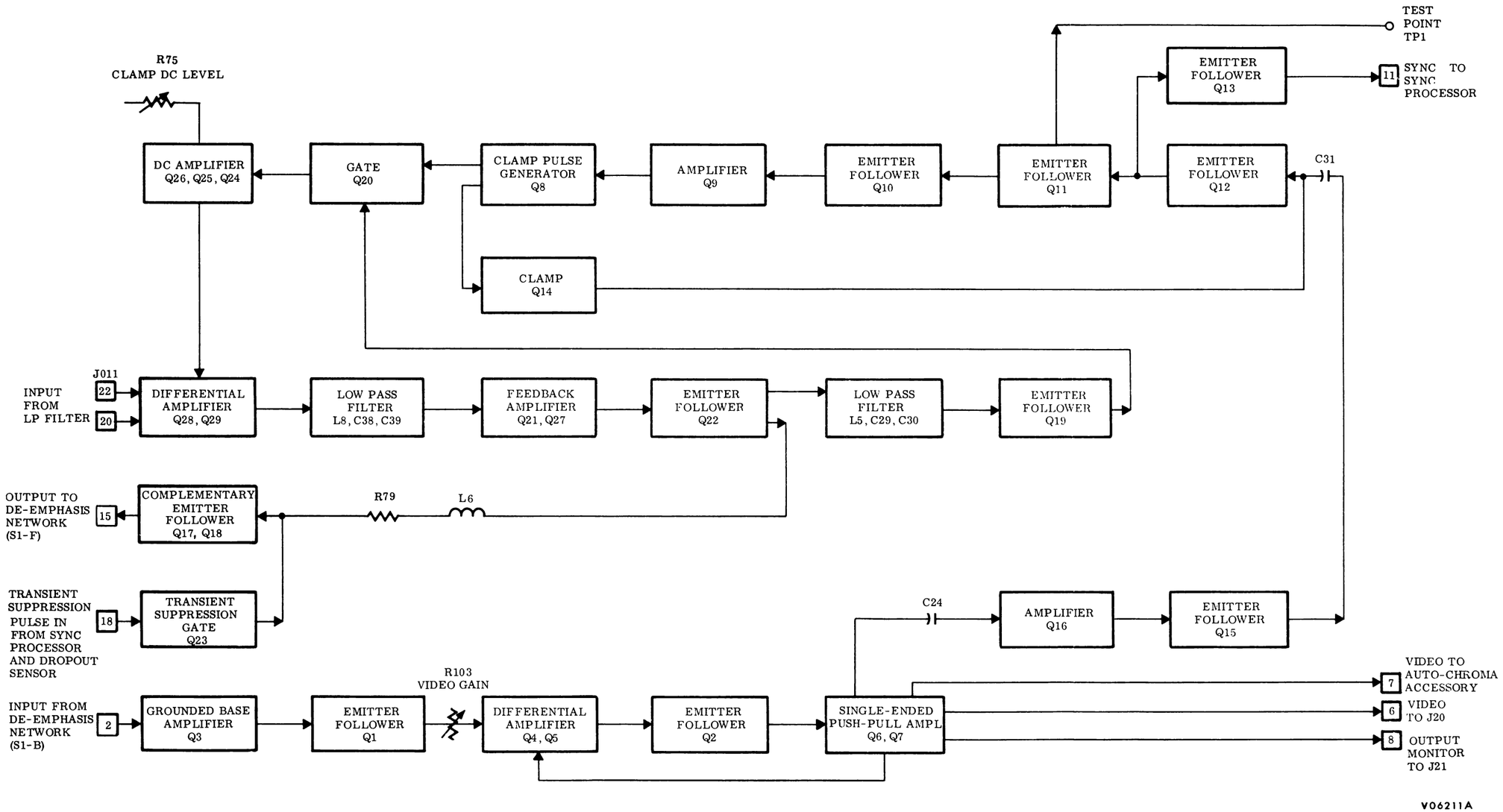


Figure 5-17. Output Video Functional Block Diagram

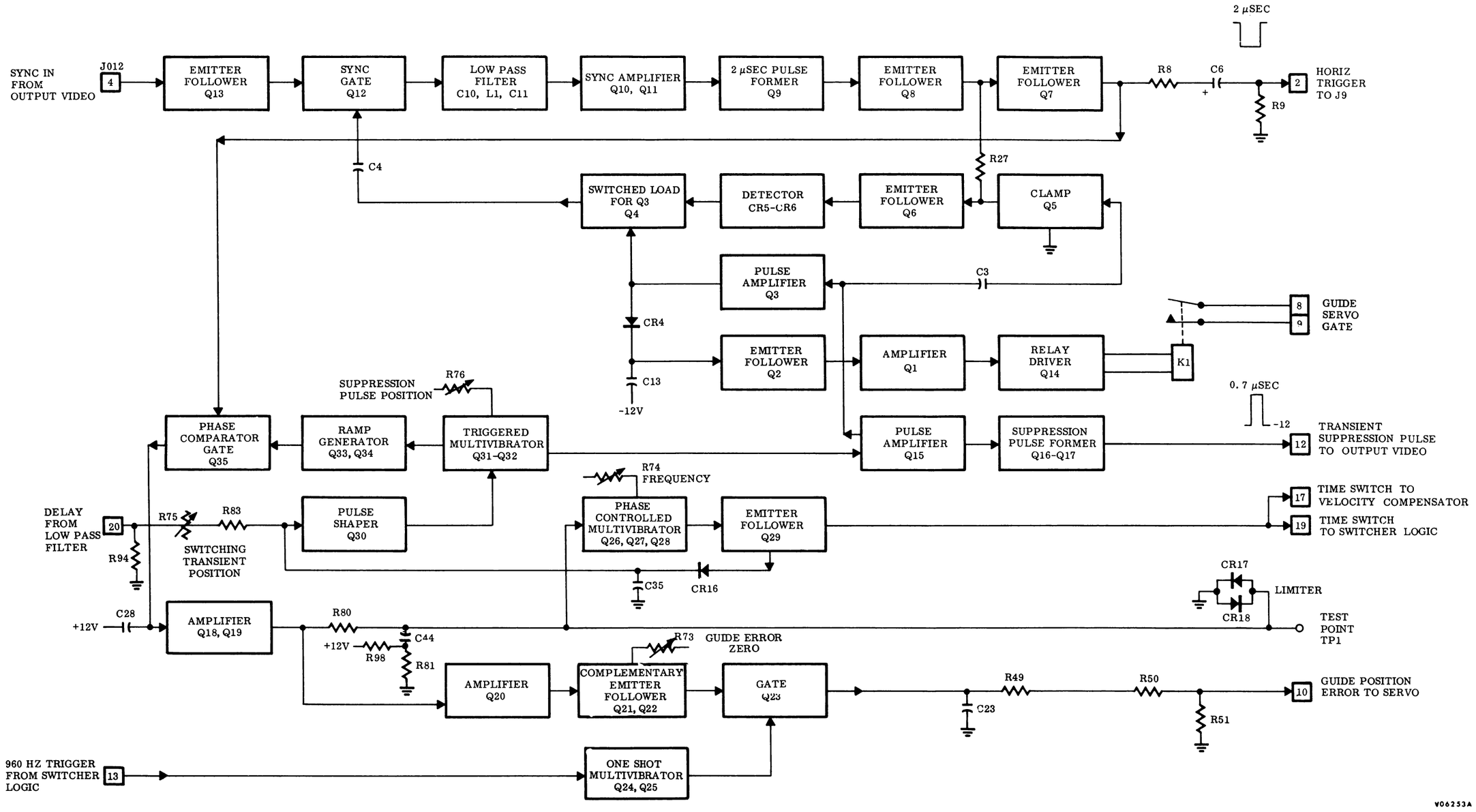


Figure 5-18. Sync Processor Functional Block Diagram

ic module in the signal system and to the velocity compensator accessory (if the VR-1200B is equipped with one). Q29 also drives the delay network composed of CR16, CR35, R83, R75, R94, and the variable delay from the low-pass filter through pin 20 of J012. The amplitude of the delayed signal is limited and amplified by Q30, and used to trigger multivibrator Q31, Q32.

5-143 The triggered multivibrator has two outputs: a 5-microsecond pulse is coupled to Q15 which drives the lock-up sensor and suppression pulse former Q16-Q17; the suppression pulse is routed through pin 12 of J012 to the output video module. The other output is a 9-microsecond pulse which drives ramp generator Q33, Q34; the exact period of the 9-microsecond pulse is set by R76, which controls the position of the suppression pulse.

5-144 Phase comparator gate Q35 is turned on by the 2-microsecond pulse from Q7, and during this interval passes a 2-microsecond portion of the negative-going (9-microsecond) part of the positive-going ramp from Q33, Q34. The level of the sample is stored in C28, passed through emitter follower Q18, and amplified and inverted by Q19. The output of Q19 is coupled to a filter composed of R80, C44, R81, and R98 and provides the control voltage for the phase-controlled multivibrator (refer to paragraph 5-141).

5-145 GUIDE POSITION ERROR SIGNAL. Horizontal timing errors caused by improper head-tip penetration into the tape (female vacuum guide placed too close or too far from the rotating head drum of the Mark Ten Head Assembly) show up as voltage displacement at the output of Q19. The same signal that drives the phasing network at the input to the phase-controlled multivibrator is amplified by Q20 and coupled through emitter-follower Q21, Q22 to gate Q23.

5-146 The 960-Hz (1000-Hz for 625-line standards) trigger from the switcher logic module turns on multivibrator Q24, Q25 at the beginning of each head pass across the tape; the multivibrator remains on for a period equal to three or four lines of video and turns on Q23, allowing the signal from Q21 and Q22 to pass to integrating capacitor C23. The voltage on C23 is routed through a resistive network R49, R50, R51 and pin 10 of J012 to the servo amplifier of the automatic guide servo system.

5-147 The guide error zero control R73 is adjusted for elimination of skewing errors in the video output signal of the VR-1200B (refer to Section VIII for alignment instructions).

5-148 Dropout Sensor and Demodulator Input Gate (Module 13)

NOTE

This module will perform all its functions only if the signal system is equipped with an afc kit and a one-line delay accessory.

5-149 When the recorder is in the playback mode, the reproduced rf signal entering at pin 4 of J013 is applied to both demodulator input gate 1, and to the first stage of the dropout sensing circuitry (see simplified block diagram Figure 5-19). If the system is equipped with a one-line delay accessory, a signal also enters the module (at pin 15) and is applied to demodulator input gate 2.

5-150 DROPOUT SENSOR STAGE. The dropout sensor stage of module 13 functions only when the recorder is in the play mode. The rf signal, from the switcher and equalizer module (approximately 0.5 volt peak-to-peak) entering the module at pin 4, is applied to the base of emitter-follower Q1 (see block diagram Figure 5-20). From Q1 the signal is coupled to the emitter of grounded-base amplifier Q4. The output of Q4 is passed through a limiter stage (CR1, CR2) which limits the a-m component of the signal. The signal is then coupled to the base of amplifier Q3; potentiometer R16 controls the gain of Q3, thereby controlling the level at which gating and switching will occur in the circuitry that follows. The

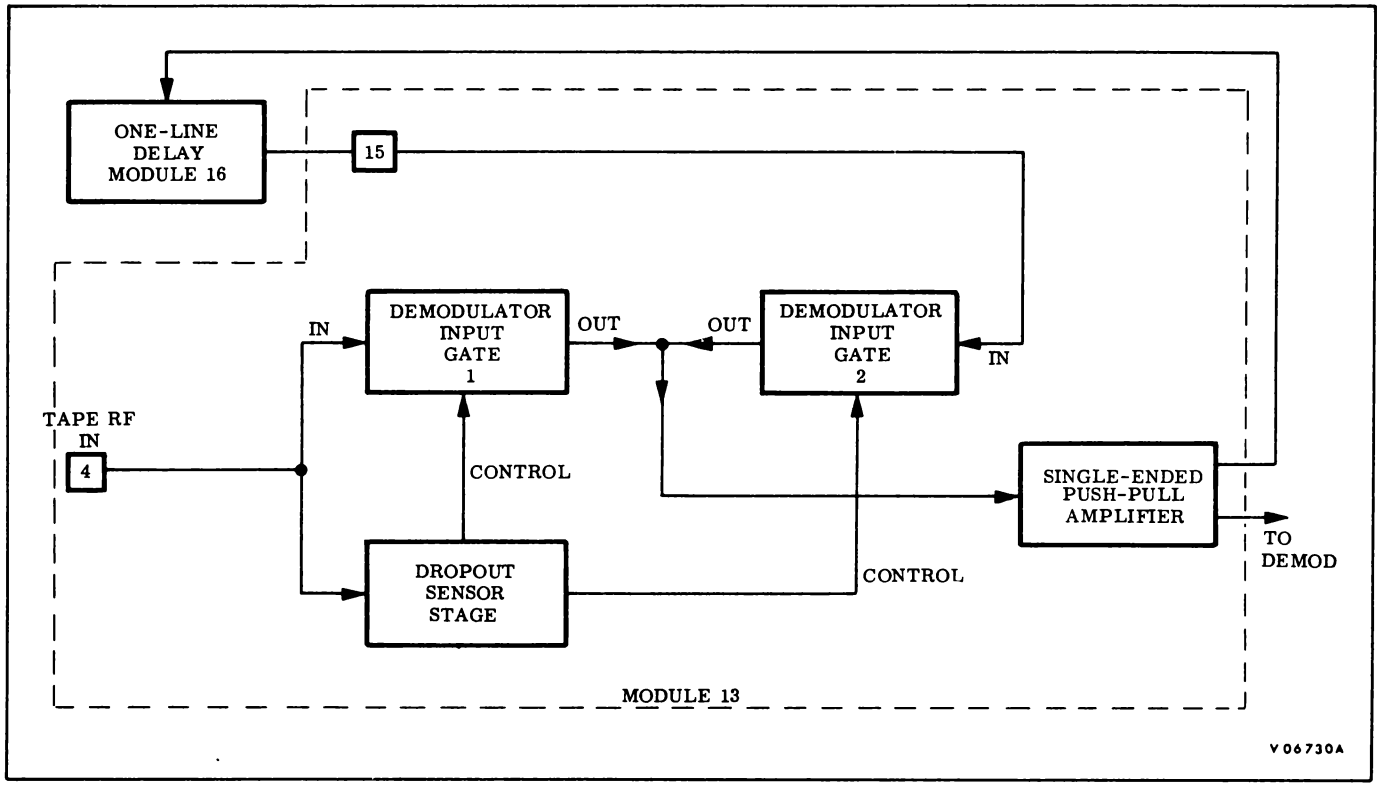


Figure 5-19. Dropout Compensation Functional Block Diagram

output of the limiter is coupled through amplifier Q2 to detector CR3, Q6, CR5, Q12. Q6 and Q12 function as a differential amplifier. The biasing of Q6 and Q12 is such that when the incoming rf signal level equals or exceeds the limiting level (normal-level tape rf), Q6 conducts and Q12 is biased off. The collector of Q12 is connected through the contact of de-energized relay K2 to an electronic switch Q14, Q15. When Q12 is off (during the time a normal level rf signal is present), the voltage at its collector causes Q14 to be biased off, and Q15 conducts. The output of Q14 is connected to Q29 of demodulator input gate 2, and the output of Q15 is connected to Q7 of demodulator input gate 1. When no dropout is present in the reproduced rf signal, Q7 is off and gate 1 is enabled, allowing the incoming normal-level rf signal to be coupled to the output amplifier.

5-151 When a tape dropout occurs, the incoming rf signal falls below the limiting level and no signal is coupled to the bases of Q6 and Q12. Under this condition, Q12 conducts and the voltage at its collector becomes less negative, causing Q14 to conduct. Q15 is then biased off, turning on Q7 of demodulator input gate 1. The output of Q14 turns emitter-follower Q29 off and gate 2 is enabled, allowing the one-line delayed rf signal to be coupled to the output amplifier. Resistor R53, in the feedback path from Q14 and Q15, maintains a forward bias on Q12 after a dropout has occurred. This circuit ensures that gate 1 will not be returned to the on condition until there is an increase in rf level of approximately 10 dB. Therefore small fluctuations in the input rf are prevented from producing a succession of erratic gate switching operations.

5-152 DEMODULATOR INPUT GATES. The demodulator input gates function in the e-e, record, and playback modes of VR-1200B operation. In the playback mode, the tape rf signal from the switcher and equalizer enters the module at pin 4 and is coupled by emitter-follower Q5 to the nor-

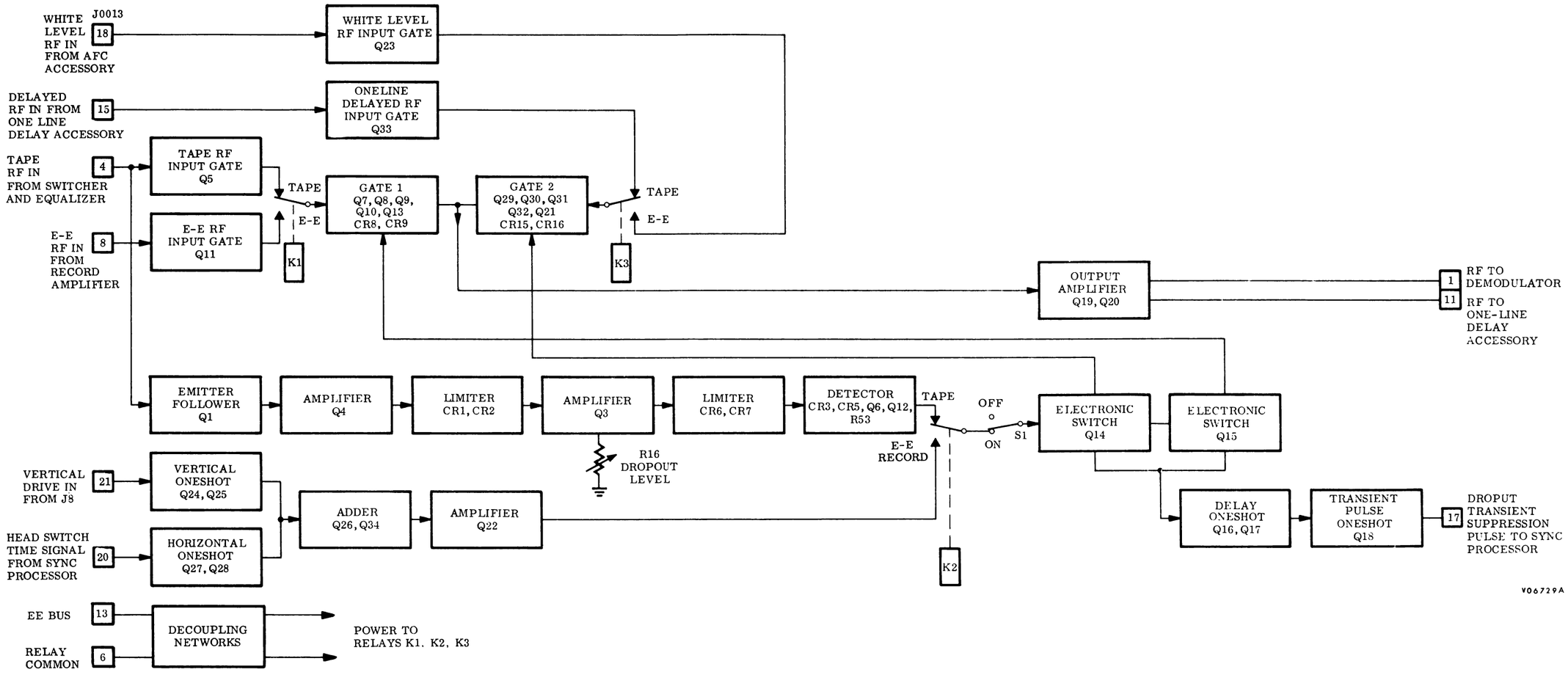


Figure 5-20. Dropout Sensor and Demodulator, Block Diagram

mally closed contact of relay K1. (See block diagram Figure 5-20.) The delayed rf signal from the one-line delay accessory (module 16) enters the module at pin 15 of J013 and is coupled by emitter-follower Q32 to the normally closed contact of relay K3.

5-153 In the record mode, the e-e rf signal from the record amplifier (module 5) enters the module at pin 3 of J013 and is coupled by emitter-follower Q11 to the normally open contact of K1. The white-level rf calibration signal enters the module at pin 18 and is coupled by emitter-follower Q23 to the normally open contact of K3. Relays K1 and K3 are de-energized in the playback mode and energized (by the e-e bus) in the record mode.

5-154 In order to simplify the description of the demodulator input gate circuitry, the functions will be divided into the following conditions:

a. Playback mode when the signal is at normal level.

b. Playback mode when a dropout is present in the signal.

c. E-e and record modes.

5-155 Playback Mode, Signal at Normal Level. When relay K1 is de-energized, the reproduced rf signal at emitter-follower Q5 is applied through K1 to the base of amplifier Q10. The output of Q10 is coupled to the collector of Q9 at gate 1. Gate 1, consisting of Q8, Q9, CR8 and CR9, constitutes a pi attenuator. When the incoming rf signal is at normal level, the dropout sensor stage provides an output that biases transistor Q7 off. With Q7 off, Q8 and Q9 are open and CR8 and CR9 are forward-biased. This is the on condition of gate 1, and the normal-level reproduced rf input is coupled through CR8, CR9 and amplifier Q13 to output amplifier Q19. The emitter of Q19 is connected to the collector of Q20. Q19 and Q20 function as a single-ended push-pull amplifier. The output of the amplifier is coupled through the emitter-collector junction of Q19, Q20 to pin 1 and pin 11 of J013. (Refer to paragraphs 5-25 through 5-28 for a description of the operation of this type of amplifier.) Pin 1 is the output to the demodulator; pin 11 is the rf output to the one-line delay module.

5-156 Playback Mode, Dropout Present. The rf signal received by the one-line delay module is delayed for the period of one horizontal line. The delayed signal is coupled through emitter-follower Q23 and the de-energized contact of relay K3 to the base of Q32. The output of Q32 is coupled to the collector of Q31 at gate 2.

5-157 Gate 2, consisting of Q31, Q30, CR16 and CR15, constitutes another pi attenuator. Gate 2 functions in the same manner as gate 1. When a tape dropout is detected, the dropout sensor turns Q29 off for the duration of the dropout. With Q29 off, diodes CR15 and CR16 are forward-biased and gate 2 is open. The delayed rf signal is then routed through CR15, CR16 to the demodulator (pin 1) and back to the one-line delay module (pin 11). The delayed normal-level rf signal is continuously gated through the circuit until the dropout is no longer present in the incoming signal.

NOTE

If the signal system is equipped with an AFC accessory, but not a one-line delay accessory, dropouts will be replaced by a line of blanking-level signal rather than the preceding line of video. This is also true if the dropout sensor ON/OFF switch is set to OFF.

5-158 Record Mode. When the system is in the record mode, relays K1 and K3 are energized by the e-e bus. Relay K2 is also energized, causing the dropout sensor stage to be isolated from the circuit. The e-e rf signal at the output of emitter-follower Q11 is coupled through K1 to gate 1. The

white-level rf signal at the output of emitter-follower Q23 is coupled through K3 to gate 2.

5-159 The e-e rf signal follows the same path through gate 1 as the reproduced rf signal in the play mode. The white-level signal from AFC follows the same path through gate 2 as the delayed tape rf signal in the playback mode. The gate enabling pulses, however, are provided by horizontal and vertical one-shot multivibrators Q24, Q25, Q27, Q28. The outputs of this stage are coupled through an adder (Q26, Q34). The added signal is then amplified by Q22 and passed through the energized contact of K2 to electronic switch Q14, Q15. The pulses that appear at the switch are such that, during the vertical portion of the signal, Q14 conducts and gate 2 is enabled, permitting the white-level rf signal to be coupled to the output amplifier. During all other portions of the composite video signal, Q14 is biased off and Q15 conducts, enabling gate 1. This permits the e-e rf signal to be coupled through to the output amplifier. Thus in the record mode of operation, the white-level and the e-e rf signals are intermittently gated to the demodulator. In this manner, by displaying the signals on the waveform monitor, the incoming signal may be adjusted to the proper level.

5-160 DROPOUT TRANSIENT-SUPPRESSION CIRCUITRY. The dropout transient-suppression stage of module 13 functions in both the playback and record modes of operation. In the playback mode, the circuit provides a pulse to compensate for transients caused by the demodulator input gates changing state at the beginning and end of a dropout. In the record mode, the circuit provides a pulse to compensate for transients caused by the demodulator input gates changing state during the vertical interval portion of the incoming composite video signal. As discussed earlier, the demodulator input gates are driven, both in the playback and record modes, by electronic switch Q14, Q15. The outputs of this switch are also used to drive delay one-shot Q16, Q17 in the transient-suppression stage. When Q14 or Q15 conducts, the one-shot delays the signal approximately 0.4 to 0.6 microsecond and applied a pulse to transient one-shot Q18. (The delay is required to ensure that the suppression pulse in the output video module coincides with the gate switching transient which has been delayed by filters in the demodulator.) The output of the transient pulse one-shot (Q18) is routed through output pin 17 to the output video module. A transistor clamp in the output video module uses the pulses from Q18 to clamp the rf transient to blanking level, thereby eliminating visible noise from the picture.

5-161 PROCESSING AMPLIFIER THEORY

5-162 The processing amplifier accepts the video output of the signal system (or the Amtec or Colortec accessory, if the system is so equipped), and provides format control for the video output of the recorder and noise-free sync pulses of broadcast quality (see block diagram Figure 5-1).

5-163 The processing amplifier functions common to monochrome and color operation are:

a. Sync stripping. The processing amplifier removes the horizontal sync pulse from the incoming video signal, and provides a non-composite video output.

b. Sync processing (GATED). The horizontal sync pulse is clipped, transients are eliminated, and the pulse is re-formed and combined with video and blanking to produce a composite video signal with extremely stable horizontal sync. (This mode is used if the system is not equipped with an Amtec accessory.)

c. Sync replacement (RE-GEN). If the noise content of the horizontal sync pulse is excessive, or if the pulse width is incorrect, the user may replace the tape sync pulse with new sync generated internally. (This mode is used if the system is equipped with an Amtec accessory.)

d. Sync replacement (EXT REF). The user may replace the tape sync with external reference sync.

e. Video noise limiting. In monochrome operation, the unit limits noise in the video portion of the output signal by preventing negative noise peaks from exceeding blanking level, and limiting white excursions to a predetermined peak level. The action is similar for color operation, but the color burst is allowed to pass intact.

f. Blanking noise limiting. All noise during the horizontal and vertical blanking intervals is eliminated.

g. Format control. The levels of the output sync, blanking, video and burst (and the ratios between these components) are independently controllable at the unit or from a remote location; in addition, the unit may be set with one switch so that the output levels are identical to the input levels.

h. Sync output. The recorder sync output is taken from the processing amplifier.

5-164 The functions required for color operation are:

a. Color burst insertion. The processing amplifier places color burst on the back porch of sync. In recorders equipped with a Colortec accessory, the user may retain the color burst from tape playback or replace it with new burst derived from a 3.58 or 4.43-MHz reference.

b. Vertical drive. The unit puts out a vertical drive signal that is used to operate the burst gate in the Colortec accessory and the signal system Auto-Chroma and dropout compensator accessories.

5-165 Detailed theory of processing amplifier operation is contained in manual 1809989.

5-166 VIDEO ERASE DRIVER THEORY

5-167 The video erase driver powers the video erase head in the record mode and contains a power oscillator, a voltage regulator, an erase-head switch, and erase-head switch control circuits. The video erase driver supplies ac at an approximate frequency of 100 kHz to the primary of transformer T1 in the supply idler and erase head assembly (refer to paragraph 4-66).

5-168 The erase driver is activated whenever the recorder is in the record mode; if the recorder is equipped with an electronic editor, however, the erase driver is activated when commanded by the editor.

5-169 Power Oscillator

5-170 Transistors Q1 and Q2 form a power oscillator, or dc-to-ac converter of the type that is commonly found in dc-to-dc power supplies. As the erase head assembly presents an inductive load (resonant with C3 at 100 kHz), the current output of this oscillator is essentially sinusoidal.

5-171 Record-bus power (positive 24 volts) is fed directly to the emitters of Q1 and Q2, and through balance control R17 and resistors R5 and R6 to their bases. The only return for this circuit, however, is through the centertap of transformer T1 in the erase head assembly. In order for the oscillator to operate, switch Q4 must be on.

5-172 Erase-Head Switch

5-173 Switch Q4 is normally biased off by resistor R3. When it is turned on by the erase-head switch control circuits, current from the centertap of T1 is coupled through Q4 to the regulated 6-volt positive output of Q3, causing the power oscillator to operate.

5-174 Erase Current Regulator

5-175 Transistor Q3, resistor R4, and zener diode CR1 form a voltage regulator for

Q4. The voltage drop across CR1 is held stable at 18 volts; at a dc input of 24 volts, the voltage drop across R4 (and the base voltage of Q3) is a positive 6 volts. This circuit sets the operating point of the Q4 collector at 6 volts positive.

5-176 Erase-Head Switch Control Circuits

5-177 Transistors Q5 and Q6 form the control circuit for the erase-head switch. The base of Q6 is normally biased on by R8. With a negative 12-volt input at pin B of J1P (provided by the electronic editor or by the editor dummy plug if no editor is present), Q6 will be turned off. When Q6 is off, the base of Q5 is coupled to the positive supply through R7, and Q5 conducts.

5-178 When Q5 is on, the base of Q4 is returned to its own collector, and Q4 conducts, allowing the power oscillator to operate.

5-179 The electronic editor inhibits the video erase driver with a positive 12-volt command; this will turn Q6 on, returning the base of Q5 to ground. Q5 will turn off, Q4 will be reverse-biased by R3, and the power oscillator will not operate.

5-180 Video Time-Base Correction

5-181 The Intersync servo system and the automatic guide servo of the VR-1200B, and the Amtec, Colortec, and velocity compensator accessories are used to maintain as high an order of time-base stability as is required for broadcast-quality stability of the particular type of video signal being played back from tape.

5-182 The Intersync servo system, through tight control of the head-drum and capstan rotational speeds and positions, reduces time-base errors in reproduced video so that the time base is locked to the local standard with an accuracy of plus or minus 100 nanoseconds. (Detailed theory of operation is contained in manual 1809927.)

5-183 The automatic guide servo, which is controlled by an error signal from the video signal system, reduces time-base errors caused by improper head-to-tape position. Errors as large as 1 microsecond are corrected to an accuracy plus or minus 50 nanoseconds. (Detailed theory of operation is contained in manual 1809974.)

5-184 The Amtec accessory is installed in the video path, and responds to time-base error on a line-by-line basis. It is therefore able to correct for error much more quickly than the automatic guide servo, although its correction range is the same; errors as large as 1 microsecond are corrected by the Amtec accessory to an accuracy of plus or minus 50 nanoseconds. (Detailed theory of operation is contained in manual 1809923.)

5-185 The Colortec accessory is also in the video path, and reduces residual time-base errors to values acceptable for broadcast-quality color playback by comparing tape burst phase with reference burst phase. Errors as large as plus or minus 280 nanoseconds are corrected to an accuracy of plus or minus 5 nanoseconds. (Detailed theory of operation is contained in manual P59560, or manual 1809984 for the Universal Colortec accessory.)

5-186 The velocity compensator accessory is not in the video path, but acts as a control unit for the Amtec and Colortec accessories. Time-base errors caused by variations in head-to-tape speeds between record and playback are reduced to a maximum of plus or minus 3 degrees of color subcarrier (referenced to burst). (Detailed theory of operation is contained in manual 1809990.)

SECTION VI

AUDIO AND CUE SIGNAL SYSTEM THEORY

SECTION VI

AUDIO AND CUE SIGNAL SYSTEM THEORY

6-1 GENERAL

6-2 The audio frequency signal functions are handled by the audio and cue chassis (see Figure 1-1) and include the following:

a. Audio channel playback (to output line)

b. Audio channel erasure

c. Audio channel recording (from input line)

d. Cue channel playback (to output line)

e. Cue channel erasure

f. Cue channel recording (locally or from line)

6-3 AUDIO SIGNAL SYSTEM THEORY

6-4 Components of the audio and cue system which are used to record and play back information from the audio track on the tape include a playback amplifier, a line amplifier, a record amplifier, and a bias and erase oscillator; two power supplies are shared with the cue channel components.

6-5 Audio Playback Amplifier

6-6 The audio playback amplifier is composed of a differential amplifier, a second stage amplifier, a response equalization circuit for tape speed, and a buffer. (Refer to Figure 6-1)

6-7 DIFFERENTIAL AMPLIFIER. The signal from the audio head is coupled by transformer T1 to pins B and C of the playback amplifier, and applied to the bases of transistors Q3 and Q5. Q3, Q2 and Q5, Q4 form a differential amplifier.

6-8 SECOND STAGE AMPLIFIER. The emitter of Q4 is connected to ground (for ac) through capacitor C3. The high output of the differential amplifier is taken from the emitter of Q2 and is amplified by Q1. The output of Q1 is fed back negatively to the differential amplifier through resistor R2 in order to stabilize the over-all gain of the amplifier. Capacitor C2 reduces the gain of the amplifier at frequencies above 15 kilohertz, and therefore reduces the noise components of the output signal.

6-9 EQUALIZATION. The output of Q1 is equalized for the selected tape speed. During operation at 7.5 ips, relay K1 is de-energized, and the equalizing network includes resistor R17, capacitor C10, and potentiometer R30, during operation at 15 ips, relay K1 is energized, and the equalizing network includes R17, C10, and potentiometer R29.

6-10 Potentiometers R29 and R30 are used to adjust each equalizing network so that it conforms to the applicable NAB or CCIR standard; capacitor C11 provides low-frequency roll-off in conformance with the applicable standard.

6-11 E-E/TAPE SELECTION. During tape playback, the equalized audio signal is coupled through the normally closed contacts of relay K2 to the base of Q8.

6-12 Diodes CR2 and CR3 are steering diodes; if pin N or pin P is positive, relay K2 becomes energized. In e-e mode, pin P is positive; in record mode, pin N is positive. Buffer Q8, Q6, Q7 is used in the play, e-e, and record modes; in play mode, the applied signal is received from the playback amplifier.

6-13 In e-e mode, relay K2 is energized and the audio signal applied to Q8 is received from the record amplifier through potentiometer R32. R32 provides for calibration or adjustment of the AUDIO meter indication in e-e mode to be identical with that in tape playback mode.

6-14 BUFFER. R33, the emitter resistor of Q8, functions as a variable resistor, and sets the gain of buffer Q8, Q6, Q7. Negative feedback from the emitter of Q7 is applied through R23 to the emitter of Q8. The emitter output of Q7 is also coupled by capacitor C8 to pin R of the board. From pin R it is routed through resistor R1 to connector J2S audio MONITOR.

6-15 Audio Line Amplifier

6-16 The output of the playback amplifier is routed through potentiometer R11 or resistor R12 (refer to Figure 6-2) to the base of transistor Q1 in the audio line amplifier. When the P.B. LEVEL control is set to UNITY, R11 is short-circuited by switch S5, and R12 provides an attenuation of 6 dB; when the control is not set to UNITY, R12 is short-circuited, and potentiometer R11 controls the amplifier gain from an attenuation of 6 dB, through unity gain, to a gain of 6 dB.

6-17 The output of Q1, Q2 is transformer coupled to J1P audio LINE OUT, and to the AUDIO terminals of METER switch S2.

6-18 Audio Record Amplifier

6-19 INPUT CIRCUITRY. The balanced audio line signal from pins 2 and 3 of J6S audio LINE IN is single-ended and coupled by transformer T3 to resistor R4 and potentiometer R3 (RECORD LEVEL); see Figure 6-3. Switch S1 (part of the R3 assembly) permits selection of the output of either R4 or R3. All of these components are mounted on the audio and cue chassis.

NOTE

Bridging transformer T3 presents a 15 kilohm impedance to the incoming 600 ohm balanced line. At any time that T3 is the only line load, a 600 ohm non-inductive resistor should be shunted across the line.

6-20 At the UNITY setting of the RECORD LEVEL control, the output from fixed resistor R4 is selected; at any other seting, the output from the wiper of R3 RECORD LEVEL is selected. The UNITY setting is used when the incoming signal level is standard, and establishes the desired +8 dBm (1.95 volts rms) for the record amplifier board; the variable control (R3) is used when the incoming signal level is non-standard and requires adjustment to +8 dBm.

6-21 AMPLIFIERS. The input signal at pin E is coupled by emitter follower Q1 through jumpered pins B and C to the top of potentiometer R5 (record level adjust). The output of R5 is amplified by Q6 and applied to the base of phase splitter Q5.

6-22 Phase splitter Q5 provides two outputs. The in-phase output, taken from the emitter, is applied to the base of Q3; the 180 degree phase-shifted output, taken from the collector, is applied to the base of Q4. The single-ended output of push-pull amplifier Q3, Q4 is taken from the point where the collector of Q3 is connected to the emitter of Q4.

6-23 BIAS. Record bias enters the record amplifier at pin V and is coupled through level control R17, to pin T, where it is combined with the amplified record signal. Bias trap L1, C6 is placed between pin T and the output of Q3, Q4 to prevent bias feedthrough.

6-24 FEEDBACK. During recording, pin T is connected by energized relay K3 to pin B of the audio record head receptacle; pin S is similarly connected to pin C. The record head return (pin S) is connected to the emitter of amplifier Q6 for negative feedback.

6-25 PRE-EMPHASIS. Pre-emphasis of the higher audio frequencies is selected by relay K1 as a function of the selected tape speed. At 15 ips, relay K1 energizes and pre-emphasis is established by R12, C4 connected to the negative feedback line; at 7.5 ips, relay K1 is de-energized and pre-emphasis is altered by the addition of C5 and R1.

NOTE

Capacitors C4 and C5 also reject the 100 kilohertz record bias frequency because of the low impedance circuit to ground they present at this frequency.

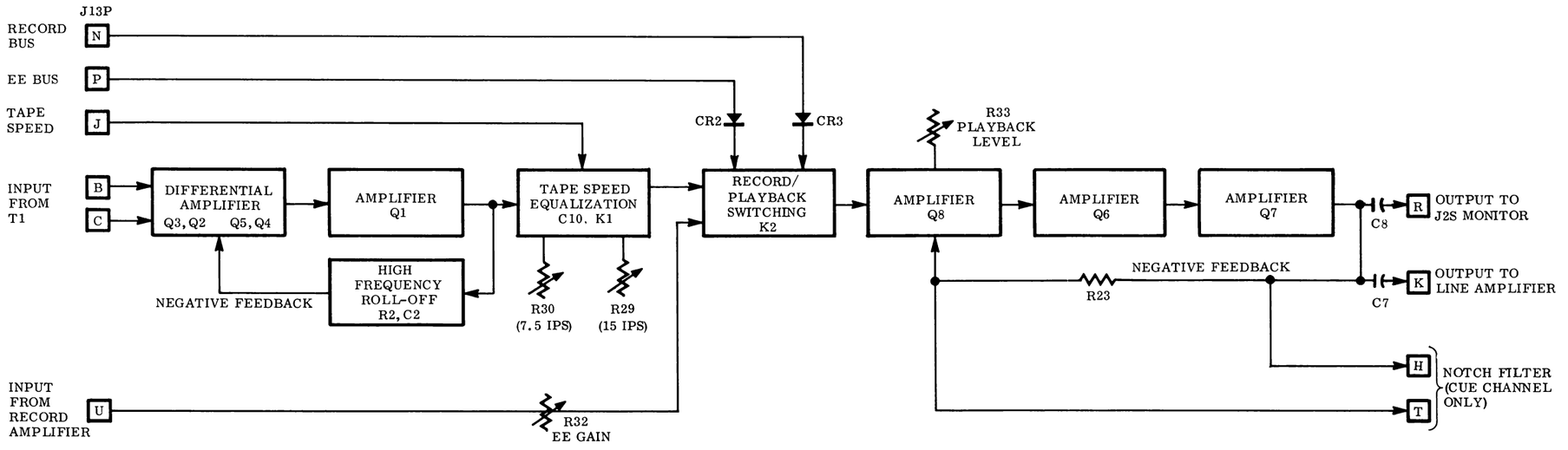


Figure 6-1. Playback Amplifier Block Diagram

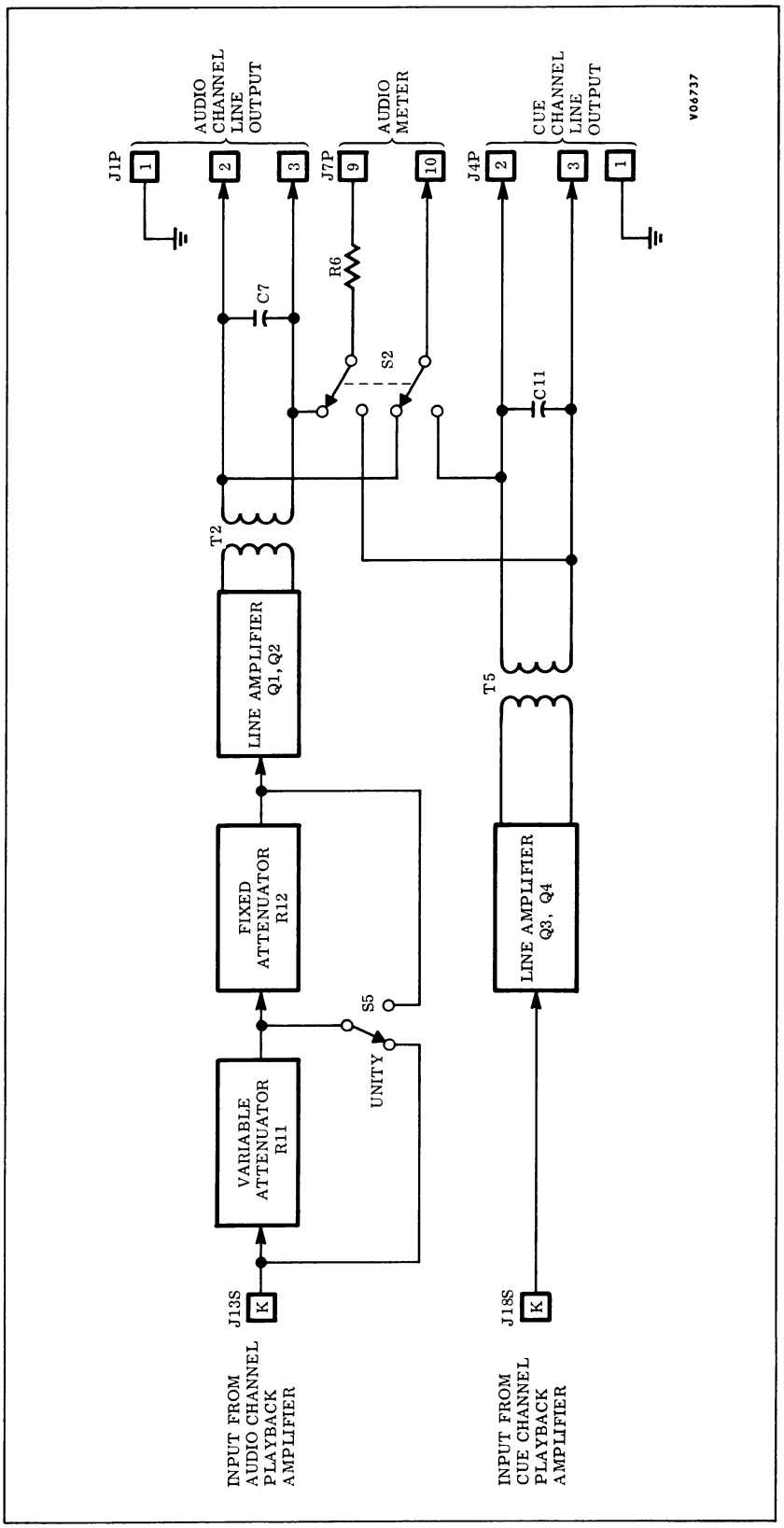


Figure 6-2. Line Amplifier Functional Block Diagram

6-26 AUDIO RECORD EQUALIZER. A record equalizer (external to the record amplifier board) is connected to pins S and K of board receptacle J15S. This series-resonant circuit includes R13, L2 and C12 built on a small board mounted on transformer T2. Its connections to the audio record amplifier place it in parallel with R12, connected to the negative feedback line. Its resonant peak is below 20 hertz. The amount of negative feedback at the lowest audio frequencies is reduced, which results in a 3 dB boost of these frequencies.

6-27 POWER SWITCH. Negative 24 volt power appears at pin L only in record mode, and is applied to transistor switch Q2 and the time constant formed by R7, R8, and C2. Capacitor C2 retards the rate at which Q2 progresses from cutoff to saturation, preventing a sudden surge of power to the record stages. In effect, this gradual turn on of power avoids recording a "pop" that a sudden power surge would generate. Conversely, when negative 24 volt power is removed by cancellation of the record mode, storage capacitor C2 discharges through R8, and the rate of turn-off is also decreased.

6-28 Audio Bias and Erase Oscillator

6-29 The audio bias and erase oscillator includes a balanced oscillator, a symmetry control, a coupling transformer, and a power bridge.

6-30 BALANCED OSCILLATOR. The balanced oscillator (free-running multivibrator Q6, Q8), generates a 100 kilohertz bias signal. The collector of each transistor drives the base of the other through an emitter follower. These emitter followers (Q5 and Q7) serve as speed-up devices to shorten the rise and fall times of the bias signal, and provide isolation of the charging capacitors to assure that the rise and fall times are equal.

6-31 Negative 24 volt power enters the oscillator board at pin P, and is routed to the collectors of Q5 and Q7 and to the center-tap of coupling transformer T1. It is also connected through thermistor R19 to a terminal of potentiometer R17, the setting of which establishes the frequency generated by Q6, Q8. R19 has a positive temperature coefficient, and increases the stability of the generated frequency. Potentiometer R17 serves as a variable resistor between R19 and the wiper of potentiometer R15.

6-32 SYMMETRY CONTROL. Potentiometer R15 permits selection of the electrical center of the series circuit R14, R15, R13 between the bases of Q6 and Q8, and compensates for variations between these components to establish equal durations of the positive and negative excursions of the generated 100 kilohertz square wave signal.

6-33 In a conventional transistor multivibrator, no oscillation will take place if both transistors are saturated when power is turned on. To eliminate this possibility, a starting circuit is provided, that applies positive 24 volts momentarily to the base of Q8 when power is turned on. Because Q8 is a pnp transistor, a positive voltage at its base will turn it off and establish the condition required for oscillation.

6-34 The starting circuit is composed of diode CR1, resistors R16 and R18, and capacitor C11 (connected to terminal S). Pin S of the etched board receptacle is connected to positive 24 volts when relay K5 is energized by initiation of record mode. The surge of positive voltage at initiation is differentiated by C11, R16, and R18 producing a positive pulse that is conducted through CR1 to the base of Q8, turning the transistor off momentarily. The positive spike is produced only at the time record mode is initiated; the instant Q8 turns off, diode CR1 isolates the starting circuit from the multivibrator.

6-35 COUPLING TRANSFORMER. The output of the balanced oscillator (taken from the collectors of Q6 and Q8) is applied to the primary winding of coupling transformer T1. Resistors R12 and R11 establish the driving impedance required by the primary winding.

6-36 POWER BRIDGE. The outputs from the 4 identical secondary windings of transformer T1 are applied individually to transistors Q1, Q2, Q3, and Q4 which comprise the power bridge. For example, winding 9-10 drives Q1, winding 7-8 drives Q2, etc. (Refer to Figure 6-4.)

6-37 The collectors of Q1 and Q3 are grounded, and the emitters of Q2 and Q4 are connected to pin F. Positive 24 volt power appears at pin F of board receptacle J14S

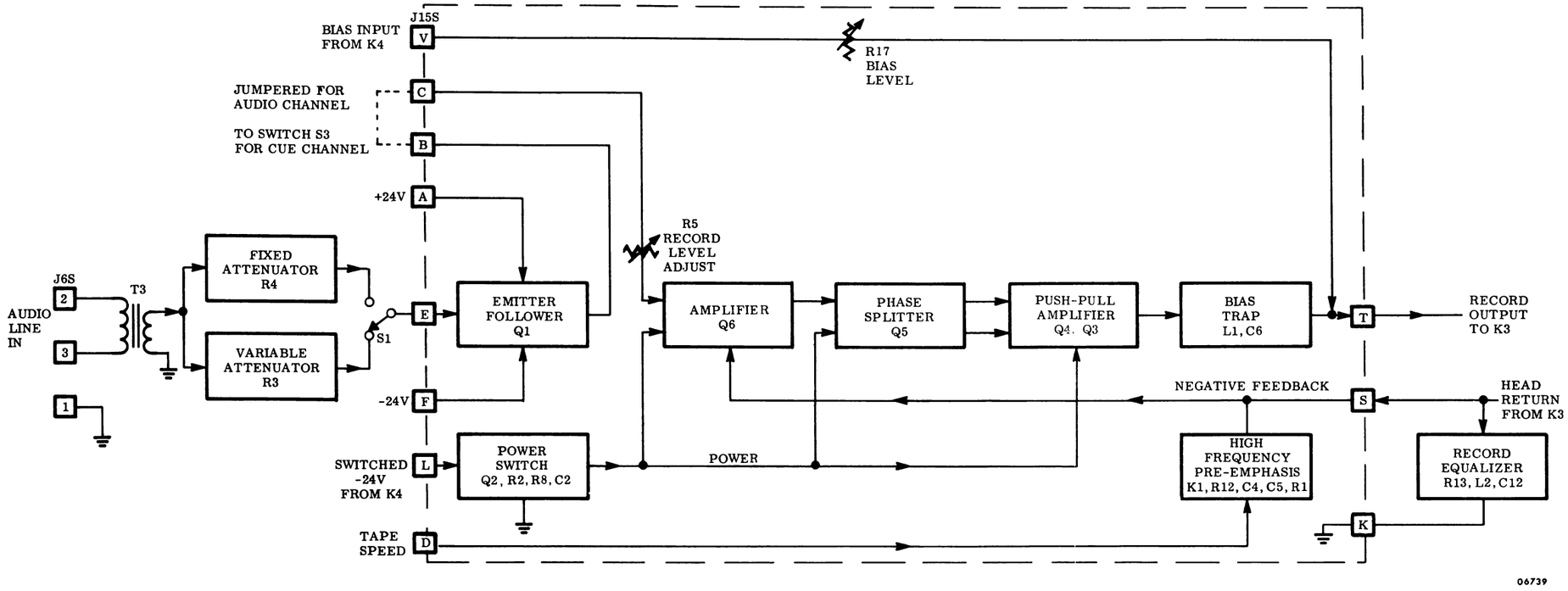


Figure 6-3. Record Amplifier Functional Block Diagram

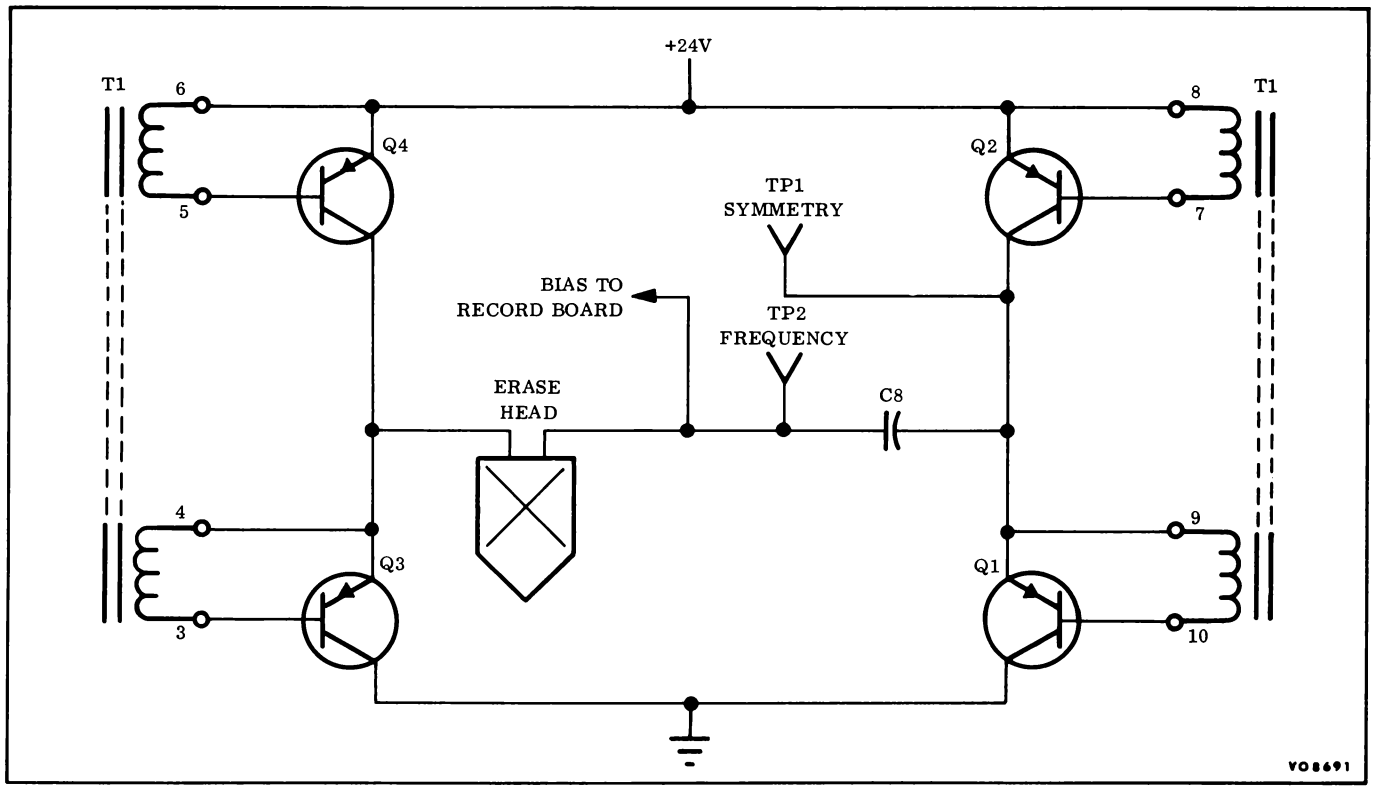


Figure 6-4. Power Bridge Simplified Schematic Diagram

only when relay K5 in the audio and cue chassis is energized by initiation of record mode.

6-38 Secondary windings 5-6 and 9-10 are in phase, causing Q4 and Q1 to turn on or off simultaneously; the same is true of windings 7-8 and 3-4, causing Q2 and Q3 to turn on or off simultaneously. The states of these transistor pairs are always opposite. For example, if Q4 and Q1 are on, Q2 and Q3 are off, and vice versa.

6-39 When Q4 and Q1 are on, the audio erase head receives power directly. At this time the ground return of the audio erase head is through C8. When Q2 and Q3 are on, the audio erase head receives power through C8. The ground return of the audio erase head is direct. The connections of positive 24 volts and ground are transposed with each change of state of the transistor pairs which results in a doubling of the voltage driving the head.

6-40 The record bias for the record amplifier board and the power applied to the erase head is taken from pin B of etched board receptacle J14S. The bias amplitude at pin B is 200 volts peak-to-peak, and is approximately sinusoidal. The erase voltage may be monitored at TP2 (Frequency); that of the 24 volt peak-to-peak square wave (prior to doubling by transposition of the erase head connections) may be monitored at TP1 (Symmetry).

6-41 CUE SIGNAL SYSTEM THEORY

6-42 Components of the audio and cue system which are used to record and play back information from the tape cue track include a cue playback amplifier, a cue line amplifier, a notch filter, a microphone preamplifier, a record amplifier, a bias and erase oscillator, and a record and erase gate.

6-43 Cue Playback Amplifier

6-44 The cue playback amplifier board is identical to that of the audio playback amplifier (refer to paragraph 6-5).

6-45 NOTCH FILTER. In the cue playback amplifier, pin H is connected to external capacitor C10 and pin T is connected to external variable inductor L1. C10 and L1 are series-connected, forming a resonant circuit that functions as a notch filter. It is tuned to the control track frequency, which it attenuates by 20 dB. The filter has a bandwidth (between 3 dB-down points) of approximately 150 to 400 hertz.

6-46 CUE LINE AMPLIFIER. The output of the cue playback amplifier is connected through pin K of J18S to line amplifier Q4, Q3 and through line transformer T5 to line output connector J4P (cue LINE OUT). These circuits are identical to the equivalent ones in the audio line amplifier (see Figure 6-2). The cue line signal is connected to the AUDIO meter when switch S2 is set at CUE.

6-47 The output of the cue playback etched board is applied directly to the associated differential amplifier, instead of through a variable attenuator, such as appears in the audio playback system.

6-48 Cue Record Amplifier

6-49 The cue record amplifier board is identical to the audio record amplifier board. Switch S3 on the front panel of the audio and cue chassis is used to select the cue input line or the output of the microphone preamplifier.

6-50 Cue Microphone Preamplifier

6-51 The microphone preamplifier is a high impedance, three stage amplifier with a gain of 46 dB (refer to the microphone preamplifier schematic diagram).

6-52 The microphone input is fed through capacitor C1 to the base of amplifier Q1. The output of Q1 is coupled to the base of amplifier Q2 through resistor R5. The output of Q2 is coupled through emitter follower Q3 and capacitor C4 to pin 5. Resistor R6 provides feedback to the emitter of Q1.

6-53 Cue Bias and Erase Oscillator

6-54 The cue bias and erase oscillator is identical to the audio bias and erase oscillator (refer to paragraph 6-28). The two bias and erase oscillators are synchronized so that they always operate at the same frequency.

6-55 Record and Erase Gate

6-56 The record and erase gate is used with the Mark II Editec accessory, and is described in manual 1809983.

SECTION VII

POWER SUPPLY AND CONTROL CIRCUIT THEORY

SECTION VII

POWER SUPPLY AND CONTROL CIRCUIT THEORY

7-1 SCOPE

7-2 This section provides theory of operation for the power supplies and the control circuits of the VR-1200B.

7-3 POWER SUPPLY IDENTIFICATION

7-4 System power supply 1800606 for the VR-1200B recorder contains a positive and negative 12 volt regulated supply 1216690, a positive 24 volt regulated supply 1211448, and a regulated positive 135 volt supply 1209480 (see Figure 7-1). The positive and negative 12 volt supply powers the video signal system, the 1021 Intersync servo system, the Mark II Editec and the Mark III Electronic Editor. The positive 24 volt supply provides power for the relays in the recorder; the positive 135 volt supply is for the Intersync servo system head drum power circuit.

7-5 The audio and cue system contains two power supply modules which provide the positive and negative 24 volts (referred to ground) used by the audio and cue electronics.

7-6 POWER SUPPLY THEORY

7-7 12 Volt Power Supply

7-8 The positive and negative 12 volt power supply (see Figure 7-1, block diagram Figure 7-2, and the schematic diagram) provides power to the solid state components in the signal system, the Intersync servo system, and the editing accessories. (The processing amplifier and the Amtec, Colortec, and velocity compensator accessories have built-in power supplies.) The operating characteristics of the supply are as follows:

a. Input voltage: 105, 115, or 125V, 50 or 60 Hz

b. Output voltages:
+12 (±0.25)V (referred to supply common)
-12 (±0.25)V (referred to supply common)
7 Vac

c. Ripple: 0.5 mVrms max

d. Regulation: ±1% max at full load

e. Output current: 4.5A max

7-9 The line input voltage is applied to the primary winding of transformer T1; the transformer tap used is a function of the line voltage (see Figure 7-2). One secondary winding provides a 7 volt, line frequency reference for the Intersync servo system. The voltage from the other secondary winding is applied to full-wave bridge rectifier CR003, CR004, CR005, CR006; the output of the rectifier (approximately 40 volts dc) is filtered by capacitors C001 and C002.

7-10 The positive output of the bridge rectifier (cathodes of CZ003 and CR005) is fed through diode CR002, shunt regulator Q001, shunt regulator Q002, resistor R005, and constant-current regulator Q003, Q004 to the negative output of the bridge (anodes of CR004 and CR006). Diodes CR001 and CR002 provide bias for the two shunt regulators.

7-11 Power supply common (0 volt) is taken at the anode of CR001 (essentially the junction of the positive and negative 12 volt shunt regulators). The power supply common output of the positive and negative sense returns are not connected to chassis ground at the power supply, but are grounded to the signal system chassis.

7-12 SERIES REGULATOR. The total current through this path is held constant by

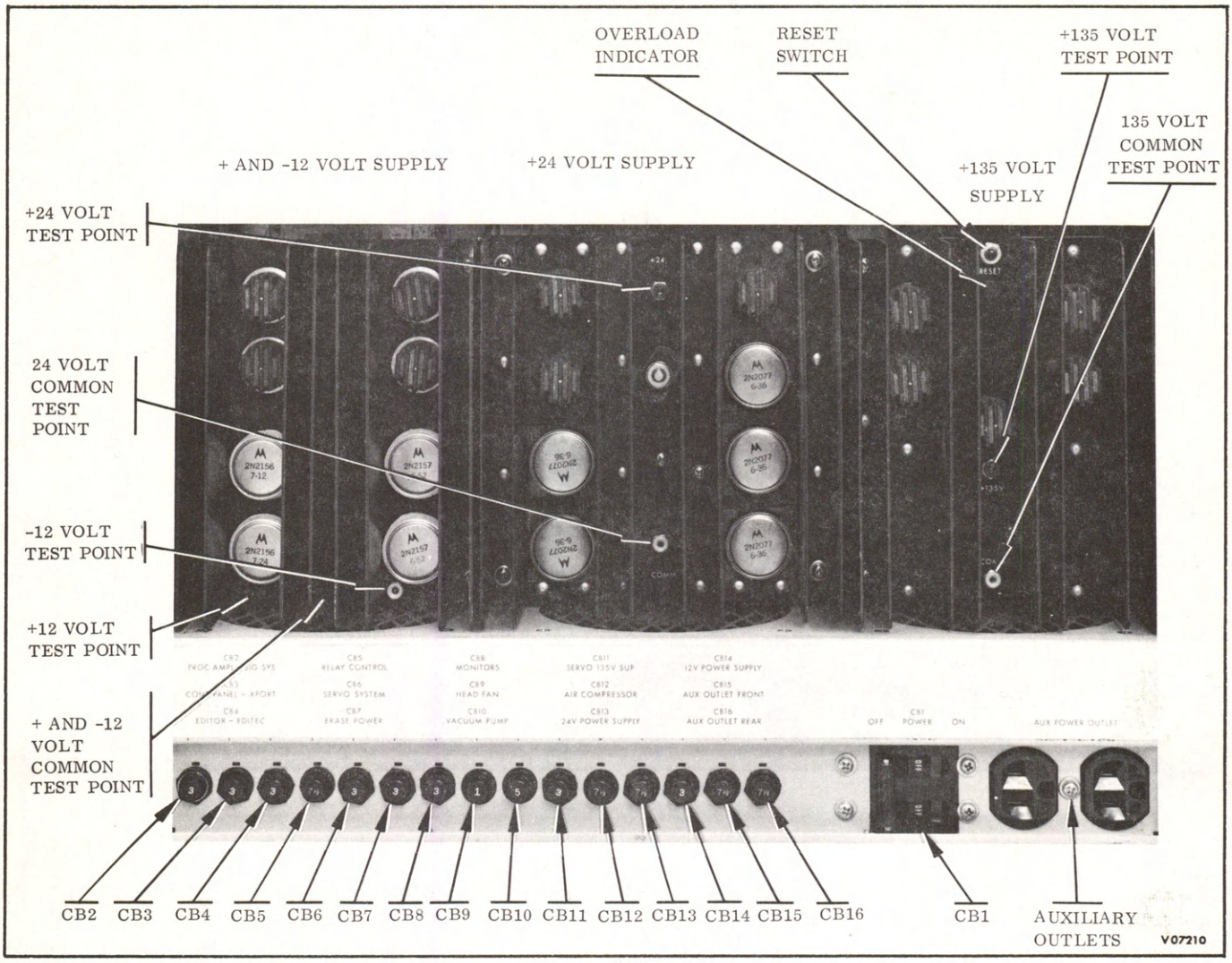


Figure 7-1. System Power Supply

series regulator Q003, Q004; regulator driver Q1, Q2, Q3, VR1 sets the level of current through the series regulator. Diode-connected transistors Q2 and Q3 and zener diode VR1 are used as a current reference; these components are temperature-compensated. Emitter follower Q1 drives the bases of Q003 and Q004 with this reference level.

7-13 As the current through the path is constant, any current which is not consumed by the power supply loads is dissipated by the shunt regulators; in order to ensure that the current dissipated is no greater than necessary, resistor R005 is inserted in the path if the Intersync servo system is not used; in all VR-1200A systems with Intersync, the harness includes a jumper across pins 18 and 20 of the power supply module connector to short circuit R005.

NOTE

As accessories are added to the VR-1200B (signal system accessories, editor, editec, etc.) the current requirements of the system will increase. To meet these current requirements, and maintain the high order of regulation necessary for the power supply, resistors R006 through R009 may be jumpered. The method for determining the correct resistance value is given in the paragraph describing the increasing of power supply current capacity in Section VIII.

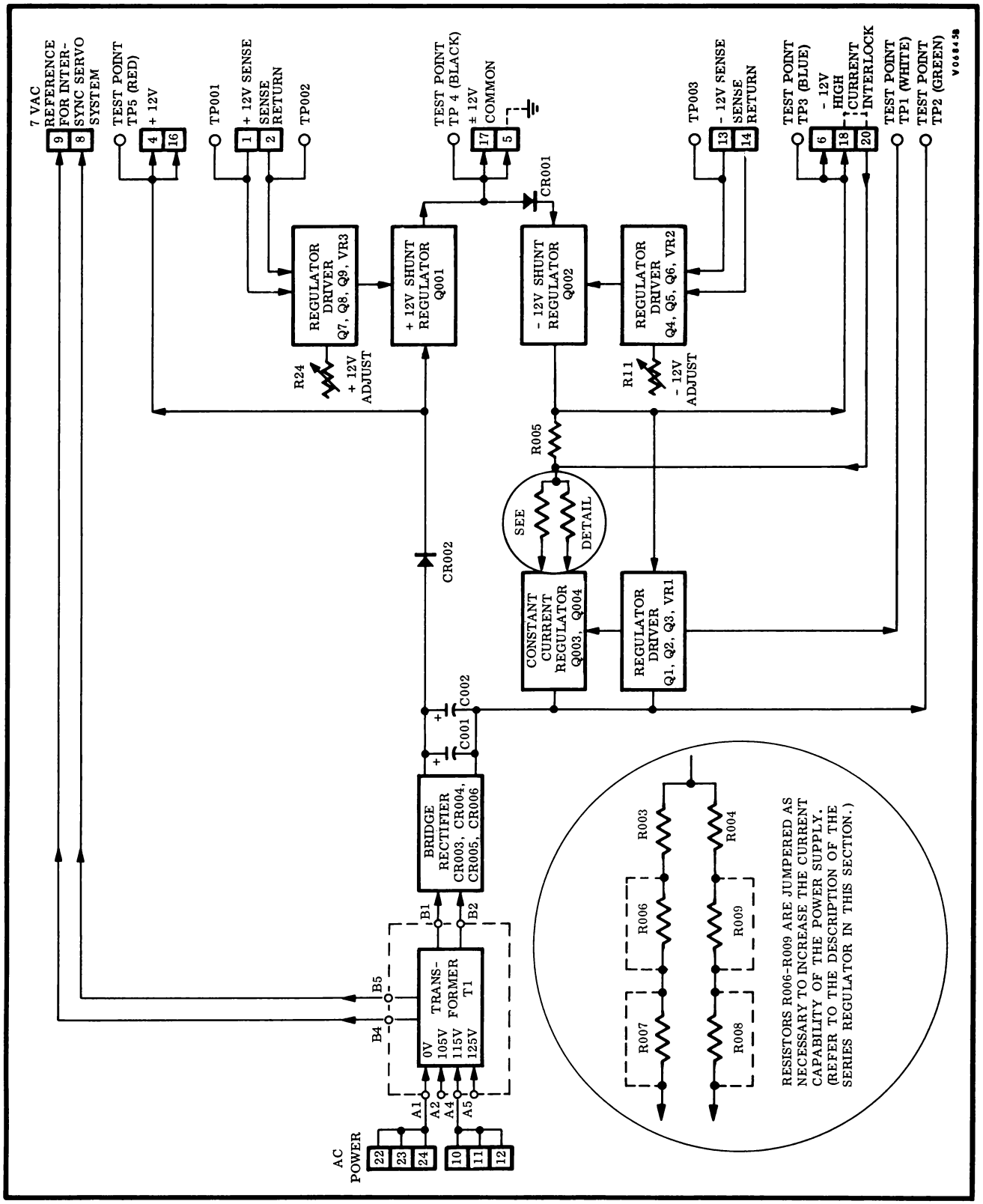


Figure 7-2. ±12 Volt Power Supply Block Diagram

7-14 SHUNT REGULATORS. Transistor Q001 is the shunt regulator for the positive 12 volt output of the power supply. (See the schematic diagram.) The output voltage is sensed at the load and fed back through voltage divider network R31, R24, R21 to a differential amplifier (dual transistor Q8) where it is compared to a 6.2 volt reference from zener diode VR3. The difference voltage is applied to the input of cascode amplifier Q9, Q7; the amplifier output drives the base of Q001, which maintains the output voltage at the load within the power supply specifications.

7-15 Transistor Q002 is the shunt regulator for the negative 12 volt output of the power supply. The regulating circuitry is similar to that described in paragraph 7-14.

7-16 Potentiometers R11 and R24 are factory adjusted to maintain the output voltages within the specified tolerances; the positive and negative 12 volt outputs are also adjusted to within 0.1 volt of one another. These controls will not require readjustment unless components within the power supply are replaced.

NOTE

The positive and negative 12 volt supply is set to an accuracy of ±1 percent, maximum; in order to maintain this accuracy, a dc voltmeter with an accuracy of ±0.1 percent maximum must be used for adjustment. A relatively inexpensive digital voltmeter (Hickock DMS 3200 or equivalent) will be satisfactory for this purpose.

7-17 24 Volt Power Supply

7-18 The positive 24 volt power supply (see Figure 7-1, block diagram Figure 7-3 and the schematic diagram) provides power for the relays and lamps in the VR-1200 recorder. The operating characteristics of the power supply are as follows:

a. Input voltage: 105, 115, or 125V, 50 or 60 Hz

b. Output voltage: +24V

c. Ripple: 0.15% rms max

d. Regulation: ±5% max at full load

e. Output current: 10A max

7-19 The line voltage input is applied to the primary winding of transformer T1; the transformer tap used is a function of the line voltage (see Figure 7-3). The voltage from the secondary winding is applied to full-wave bridge rectifier CR1, CR2, CR3, CR4. The output of the rectifier is filtered

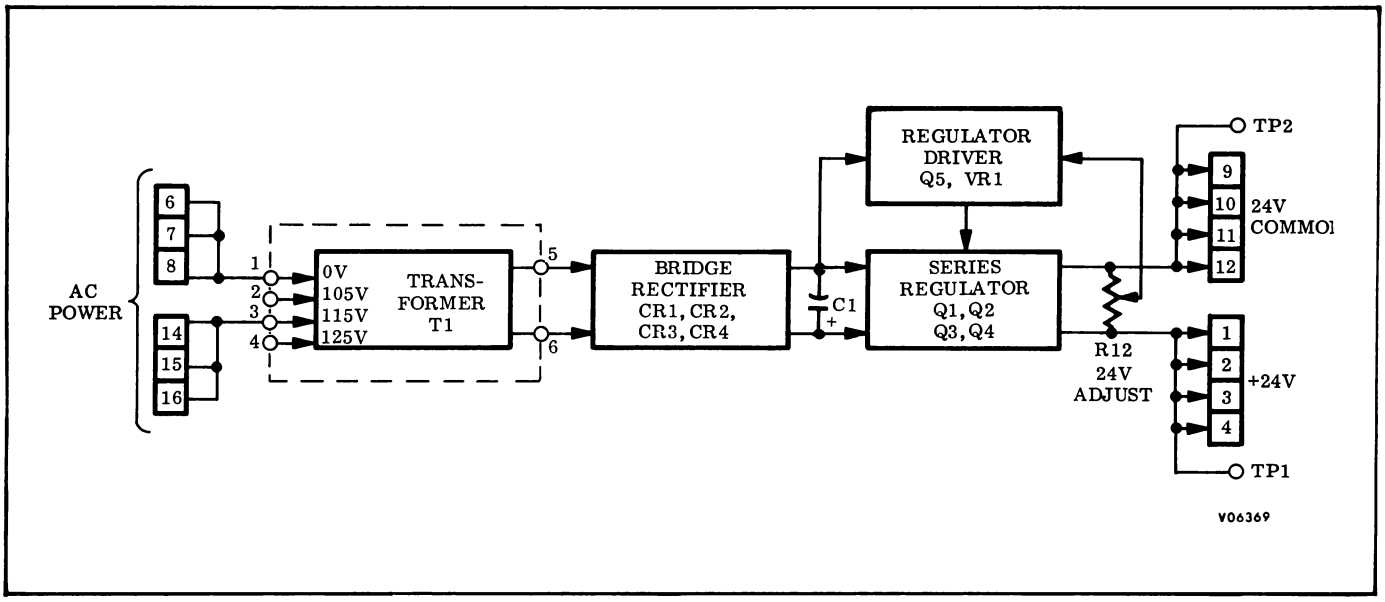


Figure 7-3. 24 Volt Power Supply Block Diagram

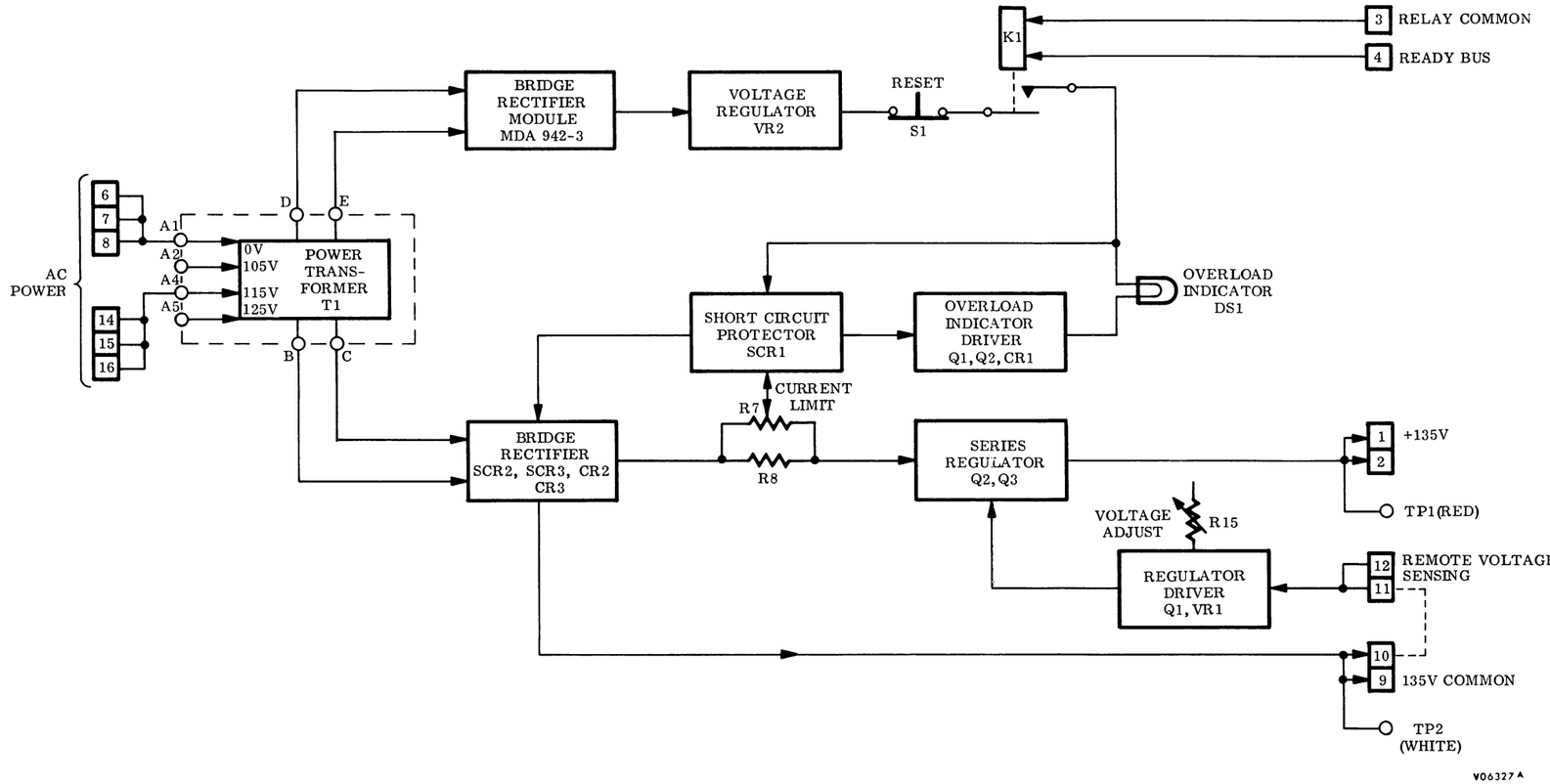


Figure 7-4. 135 Volt Power Supply Block Diagram

by capacitor C1 and applied to series regulator Q1, Q2, Q3, Q4.

7-20 Regulator driver Q5 maintains the regulator output within tolerance by comparing the difference between the output voltage (as set by R12, factory adjusted) and the voltage drop across zener diode VR1.

7-21 The power supply includes transient-suppression circuitry CR5 and C5 in the output to prevent power supply damage caused by back-emf from the relays. This circuitry also serves the function of suppressing noise pulses from the same source.

7-22 135 Volt Power Supply

7-23 The positive 135 volt power supply (see Figure 7-1, block diagram figure 7-4, and the schematic diagram) provides video head drum power through the 1021 Intersync servo system in the VR-1200B recorder. The operating characteristics of the power supply are as follows:

a. Input voltage: 105, 115 or 125V, 50 or 60 Hz

b. Output voltage: +135V

c. Ripple: 0.1% (rms) max

d. Regulation: ±3% max at full load

e. Output current: 1.0A max

7-24 The line input voltage is applied to the primary winding of transformer T1; the transformer tap used is a function of the line voltage (see Figure 7-4). The low-voltage secondary winding is connected to 24 volt bridge rectifier MDA 942-3. The high-voltage secondary winding is connected to 135 volt bridge rectifier SCR2, SCR3, CR3, CR4.

7-25 24 VOLT POWER CIRCUIT. The 24 volt power circuit (MDA 942-3, VR2) is used to gate on the silicon-controlled rectifiers (scr's) in the 135 volt bridge rectifier and also acts as the overload safety device. The dc output of the 24 volt bridge rectifier is filtered by capacitor C3 and regulated by zener diode VR2. The negative side of the 24 volt circuit is connected to the positive side of the 135 volt circuit.

7-26 135 VOLT POWER CIRCUIT. For the 135 volt bridge rectifier to conduct, the scr's in the bridge must be energized. The output of the 24 volt power supply is applied to the gates of the scr's through the normally closed RESET pushbutton and the contacts of relay K1. (K1 is energized by positive 24 volts from the ready bus in the VR-1200A whenever the READY or PLAY pushbutton has been pressed.) When energized, the scr's act as forward-biased diodes and the bridge conducts normally.

7-27 The positive output of the rectifier is coupled to series regulators Q2, Q3 which are in an emitter-follower configuration. Regulator driver Q1 maintains the regulator output within tolerance by comparing the difference between the output voltage (as set by R15) and the voltage drop across zener diode CR1. Error sensing, or remote voltage sensing is accomplished in the 135 volt common lead at the load.

7-28 The power supply includes transient-suppression diode CR5 in the output to prevent power supply damage caused by back-emf from the head drum and capstan motors.

7-29 OVERLOAD PROTECTION. In the event of an overload or a short circuit at the power supply output, the voltage drop across R8 will increase substantially. The voltage at the wiper or R7 (factory set) will rise to a level high enough to energize the short-circuit protector (SCR1). When SCR1 is energized, the voltage from the 24 volt power supply is no longer available to energize the scr's in the 135 volt bridge rectifier, and the power supply will cease operation.

7-30 In addition, when SCR1 is energized, overload indicator driver Q1, Q2, CR1 will supply a ground for overload indicator DS1, causing it to light. Removing the overload from the output will not restore the power supply to normal operation, however, because SCR1 will continue to conduct. Pressing and releasing the RESET pushbutton on the front of the power supply (see Figure 7-1) will restore the power supply to normal operation.

7-31 Audio and Cue System Power Supplies

7-32 The two power supply modules in the audio and cue chassis provide the positive

and negative 24 volt operating power for the audio and cue electronics. The outputs of both power supplies are isolated from ground, so the power supplies may be interchanged. The left-hand power supply module (viewed from the rear of the audio and cue chassis) provides negative 24 volt power; the right-hand module provides positive 24 volt power.

7-33 The operating characteristic of a typical power supply (see block diagram Figure 7-5 and the schematic diagram) are as follows:

a. Input voltage: 105, 115, or 125V, 50 or 60 Hz

b. Output voltage: 24V

c. Ripple: 30 mVp-p max

d. Regulation: ±1% max at full load

7-34 The line input voltage is applied through pins 1 and 5 of the module connector to the primary winding of power transformer T1; the transformer tap used is a function of the line voltage (see Figure 7-5). The voltage from the secondary winding (approximately 28 volts ac) is applied to full-wave bridge rectifier CR1, CR2, CR4, CR5; the output of the rectifier is filtered by capacitor C2.

7-35 The positive voltage from the rectifier is connected directly to pin 4 of the module connector; the negative output is fed through series regulator Q3 to pin 8.

7-36 The regulating circuitry includes series regulator Q3, regulator driver Q1, voltage reference CR3, and shunt regulator Q2. (See Figure 7-5.)

7-37 The output voltage of the power supply is sampled by voltage divider R1, R2, R8. The setting of potentiometer R8 controls the bias on the base of shunt regulator Q2, therefore the conduction of Q2. The current through Q2 is also passed through voltage reference (zener diode) CR3, which maintains the emitter of Q2 at a fixed voltage with respect to the negative power supply output.

7-38 A decrease in output voltage will cause Q2 to increase its conduction, increasing the voltage drop across resistor R4 (part of the series regulator driver). An output voltage increase reverses this action.

7-39 Increased voltage drop across R4 increases the base voltage of regulator driver Q1, therefore the conduction of Q1 and the conduction of series regulator Q3. The output of Q3 is routed to pin 8 of the power supply module connector.

7-40 This type of power supply is immune to short-circuit damage, and requires no manual resetting when the short-circuit has been removed. A short-circuit in the output will short-circuit voltage reference CR3; the emitter bias of Q2 will then be at zero, and Q2 will immediately cease conduction. At this point, regulator driver Q1 will cut off, cutting off series regulator Q3. Removal of the short-circuit from the output will cause the output voltage to reappear immediately.

7-41 CONTROL CIRCUIT THEORY

7-42 The control circuit functions in the VR-1200B are initiated by the user at the local or remote control panel, and performed by the system control unit.

7-43 Control circuit functions are described here in terms of the sequence of events rather than electrical connections through the various switches and relays. Complete understanding of any function may be obtained by tracing through the appropriate schematic diagrams in Section IX.

7-44 The system control unit contains the relays and other components used in the selection of the various modes of operation; this unit also contains the sequence timer assembly, which establishes the time difference between control circuit functions.

7-45 Sequence Timer

7-46 The sequence timer assembly includes four solid-state time delay circuits, connected in series. The timing sequence is started by the application of play-bus power (positive 24 volts) to pin E1 of the board assembly (see the schematic diagram of the sequence timer). The VR-1200B play bus is activated when the recorder is in either the play or the record mode.

7-47 Play-bus power is connected to pin 13 of relay SCK1 and through resistor R9 to

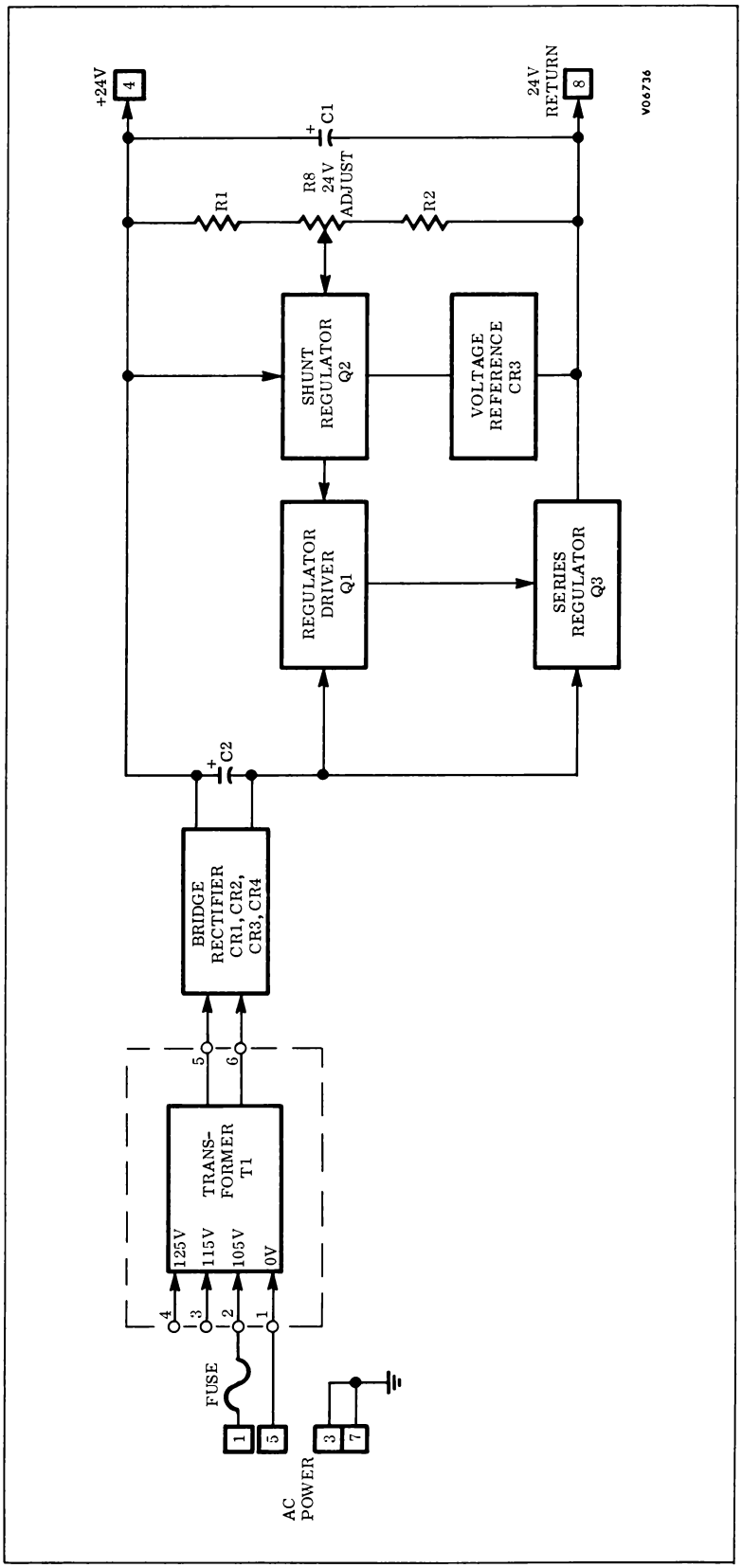


Figure 7-5. Audio and Cue Power Supply Block Diagram

the top of control R1, pin 14 of SCK1, test point TP1, and the anode of silicon-controlled-rectifier SCR1; the cathode of SCR1 is connected directly to ground.

7-48 After the period of time determined by setting of R1 (nominally 1 second), capacitor C1 charges through R9, R1, and R2 to the voltage necessary to trigger unijunction transistor Q1; C1 then discharges through R10. The pulse developed across R10 triggers the gate of SCR1. SCR1 supplies a ground for relay SCK1, which controls the functions that take place 1 second after the activation of the play bus.

7-49 In addition, relay SCK1 connects 24 volts to the 1.5 second timer; this timer energizes relay SCK2 0.5 second after SCK1 closes. The remaining timers operate in the same manner, and are energized by the timers preceding them. The relays are energized in the sequence shown in Table 7-1.

7-50 Sequence of Operations

7-51 The sequences of operations for the various modes of the VR-1200B are as follows.

7-52 PLAY MODE. The sequence of operations for the VR-1200B in the play mode is shown in Table 7-2.

7-53 PLAY MODE FROM READY. Table 7-3 describes the recorder operations when the play mode is selected and the ready mode has previously been selected.

7-54 RECORD MODE. The sequence of operations for the VR-1200B in the record mode is shown in Table 7-4.

7-55 RECORD MODE FROM READY. Table 7-5 describes the recorder operations when the record mode is selected and the ready mode has been previously selected.

Table 7-1. Sequence Control Timing

RELAY CLOSURE	TIME FROM ACTIVATION OF PLAY BUS	TIME FROM ACTIVATION OF PREVIOUS TIMER
SCK1	1 sec	-
SCK2	1.5 sec	0.5 sec
SCK3	3.8 sec	1.3 sec
SCK4	4.0 sec	0.2 sec

Table 7-2. Play Mode Sequence of Operations

TIMING	OPERATION
Play mode initiation (PLAY pushbutton pressed)	Play bus energized
	Ready bus energized
	Relay K4 (play) in system control unit activated PLAY indicator lights
	Head blower starts
	Intersync servo system activates head drum and capstan motors
	Supply and takeup turntable brake solenoids energized
	Supply and takeup turntable motors receive full power; tape motion begins
	Capstan idler solenoid energized; capstan idler engages
	TRACKING REC CURRENT meter begins tracking measurement
	Sequence timing begins
+1.5 sec	Supply and takeup turntable boost voltage removed
+3.8 sec	HEAD HOURS meter activated
	Vacuum tape-guide solenoid energized; guide moves tape up to engage rotary head drum
+4 sec	System is switched from e-e to tape mode (system is normally in e-e when tape is stopped)

Table 7-3. Play Mode from Ready Mode Sequence of Operations

TIMING	OPERATION
Before initiation (READY pushbutton pressed)	Ready bus energized
	Relay K7 (head override) in system control unit energized
	READY indicator lighted
	Head blower starts
	Intersync servo system activates head drum and capstan motors
Play mode initiation (PLAY pushbutton pressed)	Relay K4 (play) in system control unit activated
	Play bus energized
	PLAY indicator lights
	Supply and takeup turntable brake solenoids energized
	Supply and takeup turntable motors receive full power; tape motion begins
	Capstan idler solenoid energized; capstan idler engages
	TRACKING REC CURRENT meter begins tracking measurement
	Sequence timing begins
+1 sec	HEAD HOURS meter activated
	Vacuum tape guide solenoid energized; guide moves tape up to engage rotary head drum
+1.5 sec	Supply and takeup turntable motor boost voltage removed
	Ready bus function taken over by play bus
	System switched from e-e to tape mode

Table 7-4. Record Mode Sequence of Operations

TIMING	OPERATION
Record mode initiation (PLAY and RECORD pushbutton pressed)	Relay K4 (play) in system control unit activated
	Relay K5 (record) in system control unit activated PLAY indicator lights
	RECORD indicator lights
	Play bus energized
	Ready bus energized
	Record bus energized
	Head blower starts
	Video erase driver energized
	Signal system record bus activated
	Intersync servo system activates head drum and capstan motors
	Supply and takeup turntable brake solenoids activated
	Supply and takeup turntable motors receive full power; tape motion begins
	Record circuitry in audio and cue chassis activated
	Capstan idler solenoid energized; capstan idler engages
	TRACKING REC CURRENT meter begins video record current measurement
	Relays in head preamplifier module energized by signal system record bus
	Sequence timing begins
+1.5 sec	Supply and takeup turntable motor boost voltage removed
+3.8 sec	HEAD HOURS meter activated
	Vacuum tape guide solenoid energized; guide moves tape up to engage rotary head drum

Table 7-5. Record Mode from Ready Mode Sequence of Operations

TIMING	OPERATION
Before initiation (READY pushbutton pressed)	Ready bus energized
	READY indicator lighted
	Relay K7 (head override) in system control unit energized
	Head blower starts
	Intersync servo system activates head drum and capstan motors
Record mode initiation (PLAY and RECORD pushbutton pressed)	Relay K4 (play) in system control unit activated
	Relay K5 (record) in system control unit activated
	Play bus energized
	PLAY indicator lights
	Record bus energized
	RECORD indicator lights
	Video erase driver activated
	Signal system record bus activated
	Supply and takeup turntable brake solenoids activated
	Supply and takeup turntable motors receive full power; tape motion begins
	Record circuitry in audio and cue chassis activated
	Capstan idler solenoid energized; capstan idler engages
	TRACKING REC CURRENT meter begins video record current measurement
	Relays in head preamplifier module energized by signal system record bus
	Sequence timing begins
+1 sec	HEAD HOURS meter activated
	Vacuum tape guide solenoid energized; guide moves tape up to engage rotary head drum
+1.5 sec	Supply and takeup turntable motor boost voltage removed
	Ready bus function taken over by play bus

SECTION VIII

MAINTENANCE

AMPEX

FIELD ENGINEERING BULLETIN

VOLUME II PART 6
REFERENCE NUMBER 60183
SHEET NUMBER V802-1.1
MODEL NUMBER VR2000
DATE OF ISSUE Feb. 9, 1968

TITLE MANDATORY MODIFICATION TO ACCOMODATE NEW VIDEO HEAD (MUST BE PERFORMED PRIOR TO MARCH 1, 1968)

Distribution: 39-7, 40-0, 40-1, 40-2, 51-8

I APPLICABILITY

All VR2000 Videotape Recorders. (This is a mandatory modification.)

II PURPOSE

To permit usage of redesigned Video Heads.

III DISCUSSION

Effective March 1st, 1968, a minor change will be made in the manufacture of Mark Ten Video Heads having Nuvistor-type preamplifiers and used on VR2000 recorders. Heads involved will be of the 1800705-04,-049, -08, and -089 versions. To permit universal usage of the new and old types of these heads it will be necessary to add a jumper in the plug which inserts into the side of the preamplifier when the head is installed on the VR2000. This jumper must be installed between pins "S" and "M" of the plug. It is vitally important that all VR2000s be modified immediately by addition of this jumper to ensure continuity of service when replacing video heads.

IV PARTS REQUIRED

none

V PROCEDURE

Remove the cover from the plug which inserts into the side of the video head after installation and slide the cover back far enough to expose the plug terminals. Install a short jumper wire between pin "S" (which already has one lead connected to it) and previously-unused pin "M". Do not remove the wire from pin "S"; Merely cross-connect it to pin "M". Use suitable sleeving to properly insulate the connections.

Reassemble the cap to the plug and restore the machine to service.

60183
V802-1.2
VR2000

39-7
40-0
40-1
40-2
51-8

VI ADJUSTMENT

None required

SPECIAL NOTE

PERFORMANCE OF THE ABOVE MODIFICATION WILL HAVE NO EFFECT UPON USAGE OF VIDEO HEADS PRESENTLY IN STOCK, BUT WILL ENSURE THAT HEADS RECEIVED AFTER MARCH FIRST 1968 CAN BE USED. INTERCHANGEABILITY OF VIDEO HEADS WILL NOT BE AFFECTED ONCE THIS MODIFICATION IS MADE.

John Reinke,
Broadcast Video Products Unit
Technical Support Group MS 4-10

AMPEX

FIELD ENGINEERING BULLETIN

VOLUME II PART 6
REFERENCE NUMBER 60191
SHEET NUMBER G908-1.1
MODEL NUMBER General
DATE OF ISSUE 8/15/69
Distribution: 39-7, 40-0, 40-1, 40-2, 50-1, 50-2, 50-3, 50-4, 50-7, 50-8

TITLE TWO-SPEED CAPSTAN ASSEMBLY...GENERAL MAINTENANCE

NOTE: This bulletin supersedes G807-1, 60187, dated 7/8/68 and copies of this previous bulletin should be destroyed.

I APPLICABILITY

A. All Videotape Recorders (VR1100, VR1200, VR2000) on which the two-speed capstan is a standard feature.

B. All VR1000A, VR1000B, VR1000C, VR1001A, and VR1002 recorders that have been converted to two-speed operation by capstan replacement.

II PURPOSE

To outline recommended procedures designed to keep capstan and pinch roller assemblies in peak operating condition.

III DISCUSSION

There have been instances of capstan instability that have been traced to the presence of dirt, oil, and other foreign matter on the surfaces of the capstan belt and pulleys. One purpose of this bulletin is to outline the procedures that should be followed on a routine basis to ensure the best possible degree of capstan stability. The proper method of adjusting belt tension is also included in this bulletin, and should be followed each time the belt is removed or replaced. It should be emphasized that a torque screwdriver with a range capable of indicating torques in the region encompassing three to four inch-pounds MUST BE USED to set belt tension properly, and our customers are urged to obtain such a device before proceeding with the provisions of this bulletin. These tools are manufactured by several industrial tool makers and should be readily available through machine tool supply houses, or may be obtained from Ampex. (Part number 360-382)

We are also providing information covering the care and adjustment of the capstan pinch roller and solenoid assemblies which have undergone several improvements since the inception of the rotary solenoid used with the two-speed capstan.

IV PARTS AND TOOLS REQUIRED

A. Special Tools

1. Torque screwdriver, capable of measuring torques in the range encompassing 3-4 inch pounds. (See Discussion.) (Ampex part number 360-382 is recommended.)

60191
G908-1.4
General

IV PARTS AND TOOLS REQUIRED CONTINUED

VR2000B and VR1200B

All VR2000B and VR1200B machines have been factory-modified and have the new high-pressure solenoids installed.

VR2000

Slide out the Control Panel and check for the presence of two stacked 10 Ohm, 40 Watt, Power resistors mounted on the side panel of the Control Panel Chassis on the right-hand side as you face the machine. If these resistors are in place, the solenoid is already of the new type. If they are not present, we suggest that the 1805183-03 kit be purchased and installed.

VR1000 Series, VR1100, and VR1200

Check for the presence of two stacked 10 Ohm, 40 Watt, Power resistors on the rear of the System Control Unit Chassis (mounted between the mounting screws of K2 and K4). If these items are not present, we suggest that you purchase kit 1805183-03 and install.

V PROCEDURE, CAPSTAN MAINTENANCE

1. Carefully protect the exposed surface of the capstan shaft from possible damage during removal and re-installation by wrapping it liberally with masking tape or other suitable cushioning material. Be liberal with the application of this protective material, as any nicks or other physical damage to the shaft will require replacement of the entire frame assembly (see replaceable parts listing).

2. With the help of an assistant, disconnect the harness from the capstan terminal strip, remove the capstan mounting screws from the front of the top plate, and guide the capstan out through the rear of the machine. On some assemblies, there will be four shims between the frame and the top plate. All are of the same thickness, but they must be preserved for re-installation.

AMPEX

FIELD ENGINEERING BULLETIN

VOLUME PART
REFERENCE NUMBER 60191
SHEET NUMBER G908-1.5
MODEL NUMBER General
DATE OF ISSUE

TITLE

IV PARTS AND TOOLS REQUIRED CONTINUED

C. Listing of Replaceable Parts (Pinch Roller and Solenoid Assembly)

Item	Ampex P/N	Description
1.	1365625-01	Idler arm assembly, replaces 13860-01 and consists of:
	1365626-01	Pinch roller. (Replaces 13861-1)
	164834-030	Bearings, grease-lubricated (2 required)
	13866-05	Bracket ("U" shaped bracket supporting pinch roller)
	13865-01	Shaft
	406-032	Rollpin, 1/8 inch diameter by 1 inch long
	430-006	Ring, retaining (1 required)
	430-027	Ring, retaining (2 required)
	470-008	Screw, hex socket 4-40 by 1/4 inch (2 required)
	352-008	Washer, wavy spring
	13867-02	Cap
2.	1805183-03	High-pressure solenoid kit, complete

NOTE

Earlier Catalog 55670-01 solenoid assemblies should be modified by the addition of this high pressure kit if this has not been done already in Manufacture or in the Field. Whether or not this modification has already been implemented may be checked as follows:

IV PARTS AND TOOLS REQUIRED CONTINUED

B. Listing of Replaceable Parts (Capstan Assembly)

Item	Ampex P/N	Description
1.	1365624-01	(Supersedes 55570-01, 55570-02 and 55570-03) capstan assembly, complete, for all machines having Motor Power Amplifiers (vacuum tube or solid state). This capstan assembly has two power factor correction capacitors assembled to the cover plate and is used in all systems which supply sinusoidal drive signals to the motor.
2.	1211002-30	(Supersedes 1211002-10 and 1211002-20) capstan assembly, complete, for all VR1200 and VR2000 machines and for all earlier machines that have been converted to the modularized (model 1021) Intersync*. This Intersync drives the motor directly without using Power Amplifiers, and supplies square-wave drive signals to the motor. No power factor capacitors are used in this capstan assembly.
3.	1365631-01	(Supersedes 55575-03) Capstan frame assembly. This is the capstan assembly less the motor. This assembly is the lowest possible replacement in cases of damage to the capstan shaft or its bearings. Field replacement of the capstan shaft or its bearings is not sanctioned due to the extremely close tolerances involved in bearing preload tensions and shaft runout. (Shaft runout must be maintained, for example, to within .0001".)
4.	1365630-01	Belt, Mylar. (Replaces 55571-01)
5.	1211001-20	Motor, capstan, with flywheel pulley. (Replaces 1211001-10)
6.	020-988	Relay, speed change.

*Trademark Registered, Ampex Corporation

AMPEX

FIELD ENGINEERING BULLETIN

VOLUME PART
REFERENCE NUMBER 60191
SHEET NUMBER G908-1.5
MODEL NUMBER General
DATE OF ISSUE

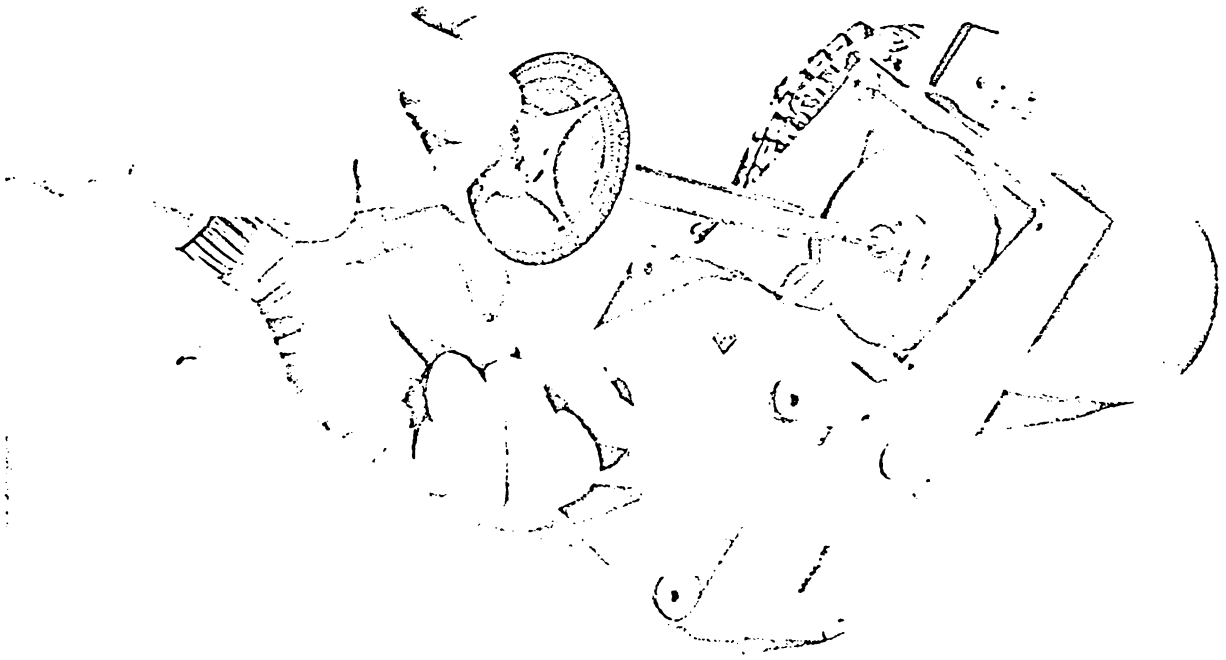
TITLE PROCEDURE, CAPSTAN MAINTENANCE, CONTINUED

3. Remove both protective covers from the capstan frame, loosen the four motor mounting screws to remove tension from the belt, and remove the belt. Take care not to crease or otherwise distort the belt if you intend to re-use it.

4. Blow residual dust and dirt from the inside of the capstan frame assembly using low pressure compressed air. Direct the air blast away from, rather than toward, the capstan shaft and bearings. Moisten a clean cloth with alcohol and clean the capstan belt if it is to be re-used. Now, clean the surfaces of the pulleys with alcohol, removing all traces of foreign matter.

5. With the motor positioned to eliminate initial tension, replace the belt. The original belt may be re-used if it does not show evidence of cracks, creases, or other distortion. If there is any doubt, it is better to replace the belt with a new one at this time.

6. Adjust belt tension as follows, referring to the attached photograph:



V PROCEDURE, CAPSTAN MAINTENANCE, CONTINUED

6. Continued

 a. Insert a 10-32 screw in the tapped hole in the exposed end of the motor shaft.

 b. Hold the capstan shaft stationary and turn the screw with a torque screwdriver. Increase tension by repositioning the motor until the belt begins to slip with a torque of 3 to 4 inch-pounds applied to the screwdriver. This is the proper tension, and this figure should not be exceeded under any circumstances.

NOTE 1

To tension the belt, it is suggested that the cover be installed on the frame assembly opposite to the capstan shaft and tension to the motor be applied by means of a large screwdriver inserted between the cover flange and the motor frame.

NOTE 2

Proper tensioning is indicated when the motor shaft does not slip with a tension of 3 inch-pounds and does slip at 4 inch-pounds.

7. Reassemble the covers to the frame assembly.

8. Again, a two-man job Carefully re-install the capstan assembly to the transport, taking special care to avoid damage to the shaft. Do not forget to replace the shims between the capstan frame and the back of the top plate if they were originally installed. All four shims, if used, are the same thickness.

9. Reconnect the harness to the capstan terminals and remove the protective coating from the capstan shaft. If there is residue from masking tape, it is best removed with kerosene, but do not permit kerosene to come in contact with the pinch roller surfaces. If the shaft is cleaned with kerosene, remove the vestiges of the kerosene with alcohol. (Kerosene attacks rubber....this is why it is used to remove the masking tape adhesive.)

AMPEX

FIELD ENGINEERING BULLETIN

VOLUME PART
REFERENCE NUMBER
SHEET NUMBER 60191
MODEL NUMBER G908-1.7
DATE OF ISSUE General

TITLE

VI CAPSTAN PINCH ROLLER NOTES

1. NEVER clean pinch roller surfaces with anything except alcohol. This preserves the resiliency and traction characteristics of the roller and ensures proper grip against the tape.

2. All previous instructions to the contrary, when adjusting pinch roller pressure after installation of the high pressure solenoid kit, the initial pulldown tension should be adjusted to between eleven and twelve pounds. Under some conditions, it is possible to achieve tensions well above this figure that can cause servo instability and even possible damage to capstan and pinch roller bearings. If it is not possible to get as high as eleven pounds, it may be necessary to enlarge or elongate the solenoid mounting holes to permit slight repositioning. The solenoid link should come very close to top dead center of the solenoid disc, but should not reach or exceed dead center because of solenoid unlocking difficulties. (See Appendix.)

3. Pinch roller bearings, when replaced, should be Ampex part number 164834-030. These are grease-packed bearings. This information supersedes all previously-disseminated information.

4. The centerline of the pinch roller and capstan shafts should be adjusted initially so that they are parallel in both planes. This adjustment will probably have to be modified slightly by shifting or bending the yoke slightly until a piece of good tape (free of edge curl or other dimensional distortions) will pass the guided edges of the audio head center post and the guide post located downstream from the audio head in PLAY mode without any distortion or wrinkling of the tape edges. This should be observed carefully with the aid of a strong concentrated light source.

John Reinke
Video Products Division
Technical Support Group MS 3-45

APPENDIX

A. Pinch Roller Pressure Adjustment

For measuring and adjustment of pinch roller pressure, use attachment supplied with kit.

1. a. Install attachment on pinch roller shaft as shown in Figure 1.
 b. Prevent capstan from rotating by removing drive voltage.
 c. Use piece of 2-inch tape between capstan and pinch roller.
 d. Energize pinch roller solenoid by pushing play button.
 e. Pull on attachment string with scale until the tape pinched between capstan and pinch roller can just be lifted with fingers away from the transport.
 f. Adjust pressure adjusting nut (Figure 1) for 11 pounds to 12 pounds as measured in e above.

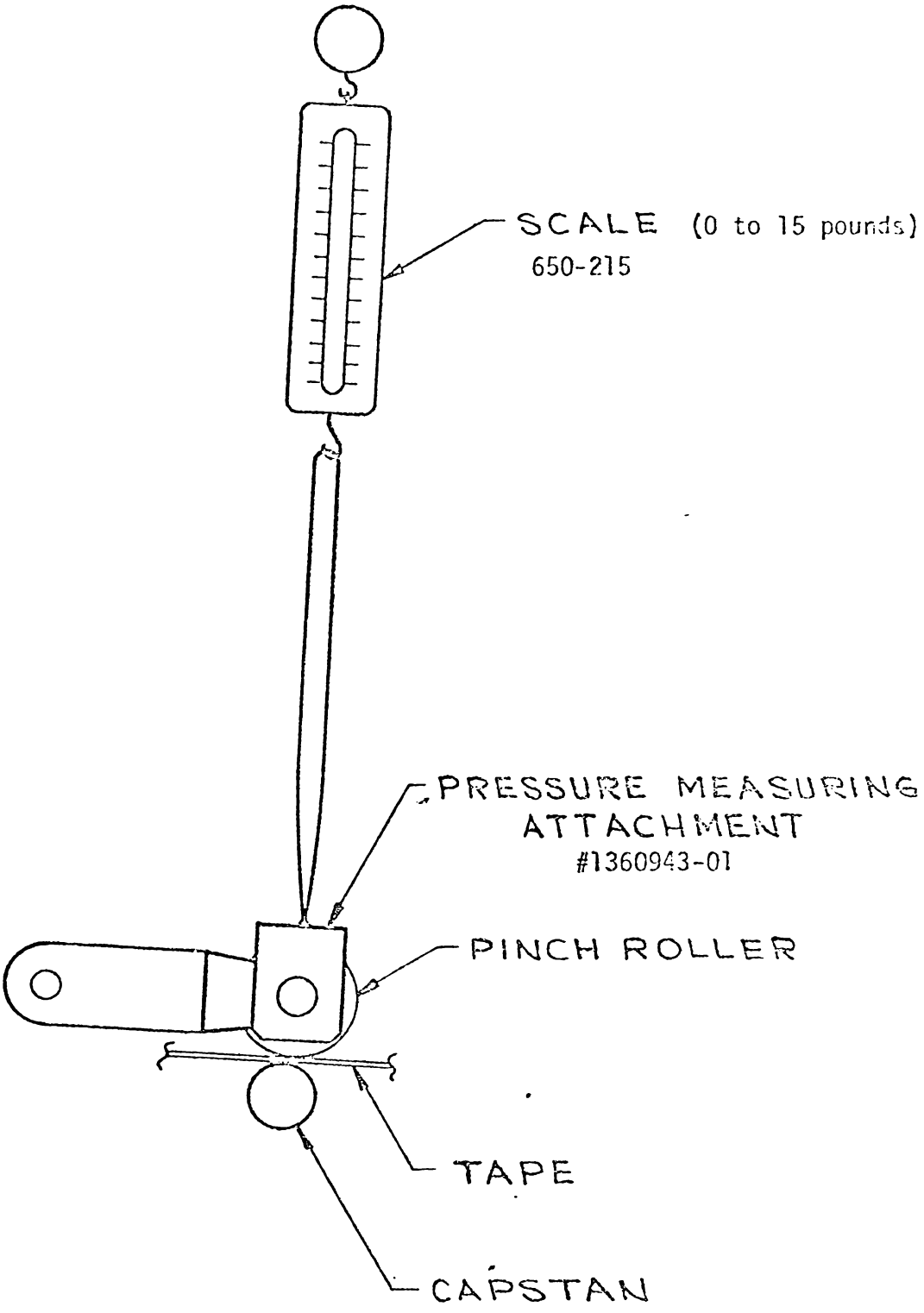
2. Repeat steps c, d, e, and f until readings on the scale remain consistent.

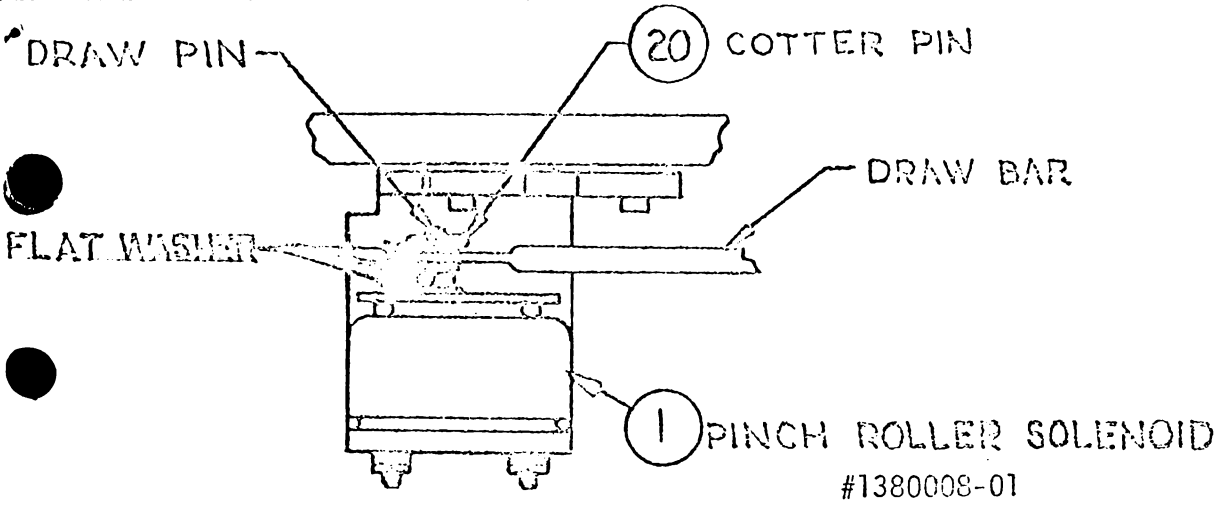
3. Remove attachment from pinch roller and be sure the capstan is free to rotate. Re-instate drive voltage.

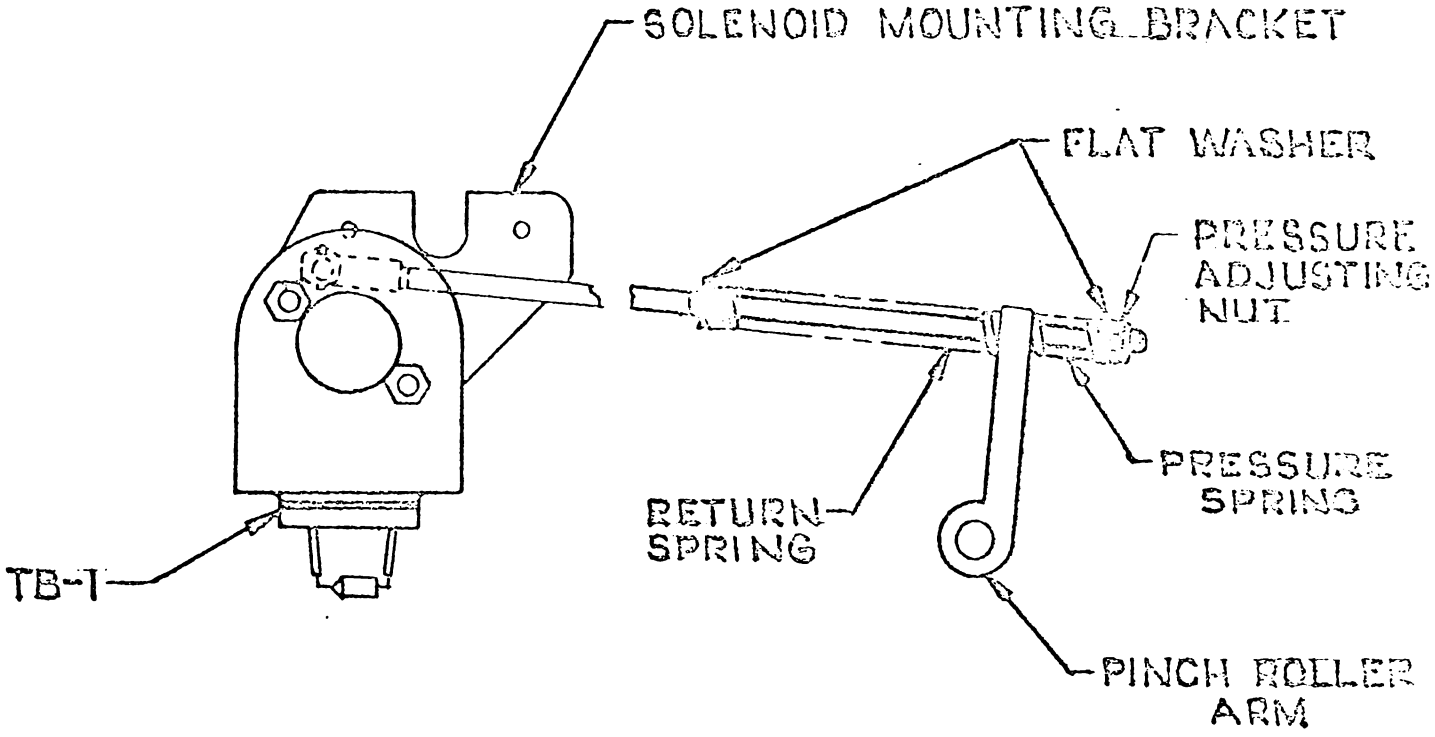
4. Check tape tracking in play mode without [ready on override], then again with [ready on override]. It may be necessary to adjust the position of the pinch roller and yoke, relative to its arm. This may be accomplished after loosening the two socket head screws on the yoke, using the modified Allen wrench supplied, then re-tightening them.

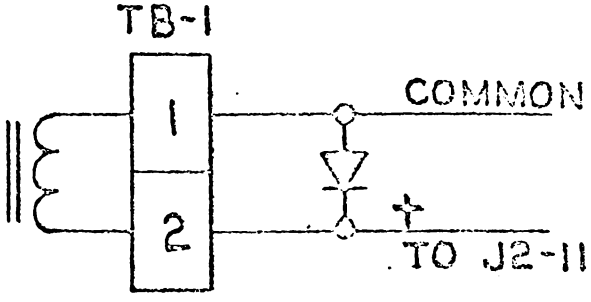
B. Normal take-up tension in playback/record mode should be re-adjusted to 24 to 25 ounces, measured at the turntable hub. For this purpose, follow the procedure described in the Operation and Maintenance Manual.

FIGURE 1


SCALE (0 to 15 pounds)
650-215
PRESSURE MEASURING ATTACHMENT
#1360943-01
PINCH ROLLER
TAPE
CAPSTAN


DRAW PIN
20 COTTER PIN
DRAW BAR
FLAT WASHER
1 PINCH ROLLER SOLENOID
#1380008-01


SOLENOID MOUNTING BRACKET
FLAT WASHER
PRESSURE ADJUSTING NUT
PRESSURE SPRING
RETURN SPRING
TB-1
PINCH ROLLER ARM


TB-1
1
2
COMMON
+
TO J2-11

SECTION VIII

MAINTENANCE

8-1 SCOPE

8-2 This Section contains routine maintenance information (including a schedule of performance), and corrective maintenance information (including corrective adjustment procedures, replacement and modification procedures, and trouble isolation information); the trouble isolation information includes waveforms of signals appearing throughout the system.

8-3 ROUTINE MAINTENANCE

8-4 Table 8-1 lists the recommended routine maintenance procedures, and the intervals at which they should be performed. When these procedures are performed, notation of their completion may be logged in the check-lists in Appendix A of this manual.

8-5 In addition, Appendix A includes a data log where information regarding the operation of the head assembly may be noted.

8-5A The VR-1200B is provided with slide-mounted chassis, removable panels, extender cards, and extender cables; these features facilitate equipment servicing and maintenance. Figure 8-1 illustrates these servicing facilities by showing the VR-1200B in a typical maintenance configuration.

8-6 Daily Maintenance

8-7 The daily maintenance procedures should be performed at the beginning of each day or each shift of recorder use.

8-8 HEAD AND TAPE PATH CLEANING. An effective cleaning agent recommended for a thorough cleaning of the tape path and the complete removal of oxide and dust accumulation is Ampex head cleaner 087-007. A soft lint-free cloth is recommended for cleaning surface areas such as the tape guides, compliance arms, and the tape timer; a Q-tip (or equivalent) is recommended for cleaning smaller or less accessible surfaces, such as the video head tips and stationary heads. When using either, moisten (but do not saturate) the applicator with the cleaning agent. When cleaning any of the heads, exercise great care to avoid scratching the tape contacting surfaces.

8-9 Access to all heads may be gained by opening the hinged head cover on the tape transport; in order to gain access to the video head tips and the control track head, the vacuum tape guide should be unlatched. (See Figure 4-11.) The cover plate below the audio and cue head assembly flips down for ease of access.

8-10 The petcock on the air bearing compressor tank should be opened daily for the first few weeks of operation, and then as often as necessary to remove all accumulated moisture from the tank. The frequency of this operation is a function of the local ambient humidity.

8-11 VACUUM GUIDE HEIGHT ADJUSTMENT. The height of the vacuum tape guide relative to the head drum is established by the setting of the large knurled knob at the lower rear of the guide assembly (see Figure 4-11). The procedure for determining whether or not the height of the vacuum guide is correct consists of making a recording, then reproducing it while moving the guide away from the video heads and simultaneously examining the waveform monitor display of the output of signal system module 6.

8-12 The rf output of each video head will decrease as head-to-tape engagement is reduced, and will fall to zero at the moment

Table 8-1. Maintenance Schedule

	PARAGRAPH REFERENCE	WHEN NEW HEAD IS INSTALLED	DAILY	25 HOURS	WEEKLY	MONTHLY	ANNUALLY	5000 HOURS
Head and tape path cleaning	8-8	x	x					
Compressor tank draining	8-10		x	(or as required)				
Vacuum guide height adjustment	8-11	x	x					
Monochrome performance check	8-14	x	x					
Color performance check	8-16	x	x					
Vacuum guide standard position check	8-21	x						
Control track current check	8-22	x						
Head tip projection measurement	8-24	x						
Video record current setting	8-30	x		x				
Head demagnetization	8-33	x			x			
Filter cleaning	8-38				x			
Intersync servo check	8-47				x			
Filter replacement	8-49					x		
Modulator frequency check	8-50					x		
Audio and cue system performance check	8-51					x		
Check of transport adjustments	8-52					x		
Intersync servo check	8-64					x		

Table 8-1. Maintenance Schedule (Continued)

ITEM	PARAGRAPH REFERENCE	WHEN NEW HEAD IS INSTALLED	DAILY	25 HOURS	WEEKLY	MONTHLY	ANNUALLY	5000 HOURS
Fan lubrication	8-65						x	
Compressor overhaul	8-66							x

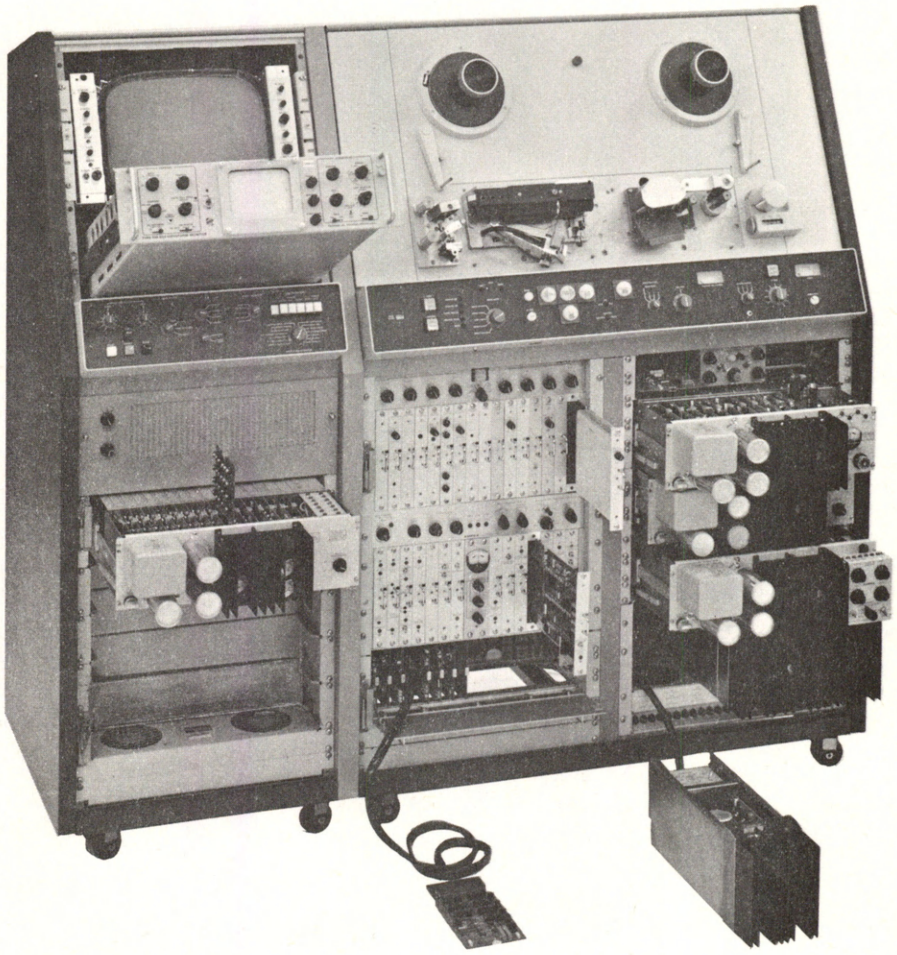


Figure 8-1. Typical Maintenance Configuration

the heads lose contact with the tape. If the guide height is correct, the trace of each head output will remain essentially level until head output ceases. If the guide is too high or too low, the trace of each head will become a somewhat ragged slope that tilts one way or the other just before head-to-tape contact is lost.

8-13 The detailed procedure for checking guide height is as follows:

a. Set the REC/PLAY lever on the video head assembly to REC. Turn the WAVEFORM MONITOR selector to SWR R.F. OUTPUT.

b. Make a 1-min recording of any conveniently available video signal.

c. Set the REC/PLAY lever on the video head assembly to PLAY. Reproduce the recording made in step b. Examine the waveform monitor display for a few seconds, then press the TIP PROJ mode selector pushbutton (on the main control panel) to MAN mode, and slowly turn the TIP PROJ control ccw to cause the guide to move away from the head drum, while continuing to observe the display.

d. Leave the TIP PROJ control at the setting just prior to the cessation of head output, and adjust the guide height knob until the traces of head output are level.

NOTE

The adjustment of guide height made in step d should be tested by repeating steps a through c and determining that the traces exhibit no slope. If the adjustment has been made correctly, a recording made and played back at the standard head-to-tape engagement should exhibit an almost perfectly level envelope for each channel.

8-14 MONOCHROME PERFORMANCE CHECK. The monochrome performance check consists of recording and playing back a multiburst test signal, and adjusting the playback equalization controls for flat response. The playback equalization control settings should be noted for future reference so that the recorder may be returned to normal operating status after a special tape run, or if the controls are accidentally moved.

8-15 In color-equipped systems, the color performance check of paragraph 8-16 supersedes these procedures. The monochrome performance checks are as follows:

a. Connect a 1 Vp-p multiburst test signal to the video input connector on the VR-1200B external connector panel.

NOTE

If no test signal is available, thread the alignment tape supplied with the recorder on the transport, and perform steps f and g.

b. Thread a roll of degaussed tape on the tape transport.

c. Set the head assembly REC/PLAY lever to REC.

d. Place the recorder in the e-e mode, and adjust the signal system for unity gain.

e. Record 2 to 5 min of the multiburst test signal, then rewind the tape to the starting position.

f. Set the four PLAYBACK EQUALIZATION controls to zero. Play back the tape; adjust the MASTER EQUALIZER control so that the average frequency response of the four head channels is flat.

g. Adjust the PLAYBACK EQUALIZATION controls so that the frequency response of each head channel is flat.

h. Press the A/B switch and determine that the video output is of the same quality as the input.

i. Stop the transport.

8-16 COLOR PERFORMANCE CHECK. The color performance check consists of recording and playing back a color bar test signal, and adjusting the playback equalization controls for flat response and proper color saturation. The playback equalization control settings should be noted for future reference so that the recorder may be returned to normal operating status after a special tape run, or if the controls are accidentally moved.

8-17 The color performance checks are as follows:

a. Connect a 1 Vp-p color bar test signal to the video input connector on the VR-1200B external connector panel.

b. Thread a roll of degaussed tape on the tape transport.

c. Set the head assembly REC/PLAY lever to REC.

d. Place the recorder in the e-e mode, and adjust the signal system for unity gain.

e. Record 2 to 5 min of the color bar test signal, then rewind the tape to the starting position.

f. Set the four PLAYBACK EQUALIZATION controls to zero. Play back the tape; adjust the MASTER EQUALIZER for unity chroma gain (chroma level of the tape signal is equal to that of the input signal).

g. Set the PLAYBACK EQUALIZATION controls to eliminate color-banding on the color monitor (color saturation of each channel is identical).

h. Switch the color monitor input between the color bar test signal and the output of the VR-1200B; the hues of the color bars should be matched. If the hues are not matched, it is an indication of improper burst phase; this may be corrected by adjusting DL1 on board 19 of the processing amplifier.

i. Stop the transport.

8-18 The following procedure describes a more accurate method of detecting color phase shift:

a. Display the input test signal and the VR-1200B output signal on a dual-channel vectorscope (Tektronix 526 or equivalent).

b. Play back the tape recorded in step e of paragraph 8-17; if necessary, adjust the Colortec accessory COLOR PHASE control so that one display is superimposed over the other on the vectorscope.

c. The dots on the vectorscope display should be in exactly the same positions (the VR-1200B output signal dots may be somewhat larger, due to the addition of noise and possible guide position errors).

d. Any difference in the positions of the dots indicates color phase shift. This may be corrected by adjusting DL1 on board 19 of the processing amplifier.

8-19 Head Assembly Replacement Checks

8-20 The following checks, in addition to the daily maintenance procedures, should be performed whenever a Mark Ten Head Assembly is replaced in the VR-1200B.

8-21 VACUUM GUIDE STANDARD POSITION CHECK. The following procedures should be followed to check the vacuum guide standard position:

a. Turn system power on and thread the alignment tape supplied with the VR-1200B onto the tape transport.

b. Set the head assembly REC/PLAY lever to REC and play back the tape.

c. Observe the video monitor to determine if any skewing is present (see Figure 3-15).

d. If any skewing is present, it may be eliminated by adjusting the Allenhead screw directly below the REC/PLAY lever (refer to manual 1809956).

8-22 CONTROL TRACK RECORD CURRENT CHECK. The value of optimum control track record current is a function of the characteristics of the particular video head assembly (which includes the control track head) in use and the characteristics of the magnetic tape used.

8-23 The following procedure should be used to set the level of control track current that results in a playback waveform resembling the middle waveform in Figure 8-1A; the small vertical spikes shown in Figure 8-1 (not to be confused with the large frame pulse) indicate that the tape has reached saturation at each zero-crossing of the record current waveform.

step d) is available at TP2 CONTROL TRACK UNFILTERED PLAYBACK on Intersync module 10.

b. Set the WAVEFORM MONITOR selector to C.T. REC. CURRENT, and place the VR-1200A in the record mode; check the control track record current level against the values previously recorded in the data log in Appendix A of this manual.

c. Record for two or three min, then stop the transport and return the tape to the start of the recording.

d. Set the WAVEFORM MONITOR selector to C.T. PLAYBACK.

e. Play back the recording and observe the waveform of the control track signal; it should closely resemble the middle waveform in Figure 8-1, including the vertical spikes. If the vertical spikes are absent, skip step f and continue with step g.

f. Set the WAVEFORM MONITOR selector to C.T. PLAYBACK (FILTERED), or monitor TP6 CONTROL TRACK FILTERED PLAYBACK on Intersync module 11; the control track playback waveform should be a sine wave, approximately 0.5 Vp-p.

g. If the control track waveforms are not satisfactory, adjust R1 CONTROL TRACK RECORD LEVEL and repeat steps c through f until the requirements of step e are satisfied.

h. If the waveforms are satisfactory, but the playback level of the filtered control track is too low, adjust R79 CONTROL TRACK PLAYBACK LEVEL on Intersync module 11.

8-24 HEAD TIP PROJECTION MEASUREMENT. Head-tip projection should be measured when a head is replaced, or when the output from a particular video head appears abnormally low. A special gauge 1209742 for the measurement of head-tip projection (projection beyond the surface of the head drum) of the head assembly is shipped with each VR-1200B recorder.

8-85 Complete instructions for the proper use of this gauge are contained in manual 1809956 supplied with the Mark Ten Head Assembly.

8-26 The head-tip projection readings may be recorded in the 25-hour maintenance check-list and data log in the Appendix A of this manual.

8-27 Head tip projection may also be checked on Dial Indicator Test Stand 1800798 in accordance with the instructions in manual 1809007.

8-28 25-Hour Maintenance Procedure

8-29 The 25-hour maintenance procedure consists of a video record current adjustment.

8-30 To compensate for head wear, the rf recording current from the signal system should be adjusted for the optimum value at least every 25 hours of head use, as read on the HEAD HOURS meter.

8-31 The RECORD CURRENT meter readings may be recorded for future reference in the 25-hour maintenance check-list and data log in Appendix A of this manual. Perform the record current adjustment procedures as follows:

a. Turn the system power on, and thread a roll of degaussed tape on the transport.

b. Connect a 1V p-p multiburst video signal to the VIDEO IN connector on the external connector panel.

c. Set the VIDEO GAIN control of the signal system output video module to the UNITY position.

d. Set the controls of the waveform monitor to display the output of the demodulator. Adjust the VIDEO GAIN control of the modulator to obtain a 1V p-p signal at the output of the demodulator. If the level of the multiburst signal is 1V p-p, the modulator VIDEO GAIN control should be set to the UNITY position.

e. Set the servo mode selector to the NORM position.

8-26 The head-tip projection readings may be recorded in the 25-hour maintenance check-list and data log in the Appendix of this manual.

8-27 Head tip projection may also be checked on Dial Indicator Test Stand 1800798 in accordance with the instructions in manual 1809007.

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8-31 The RECORD CURRENT meter readings may be recorded for future reference in the 25-hour maintenance check-list and data log in the Appendix of this manual. Perform the record current adjustment procedures as follows:

a. Turn the system power on, and thread a roll of degaussed tape on the transport.

b. Connect a 1V p-p multiburst video signal to the VIDEO IN connector on the external connector panel.

c. Set the VIDEO GAIN control of the signal system output video module to the UNITY position.

d. Set the controls of the waveform monitor to display the output of the demodulator. Adjust the VIDEO GAIN control of the modulator to obtain a 1V p-p signal at the output of the demodulator. If the level of the multiburst signal is 1V p-p, the modulator VIDEO GAIN control should be set to the UNITY position.

e. Set the servo mode selector to the NORM position.

NOTE

The following steps describe the setting of optimum record current using the optional waveform monitor. The TRACKING meter may be used instead, but the readout will not be as definitive. If the recorder is equipped with a video head optimizer accessory, follow the instructions in manual 1809000 instead of the following steps.

f. Set the controls of the waveform monitor to display the output of the signal system channel amplifier module (SWR R.F. OUTPUT).

g. Place the system in the record mode by simultaneously pressing the PLAY and RECORD buttons. Place the RECORD CURRENT selector in the channel 1 position. Rotate the CH1 RECORD LEVEL control from minimum to maximum and note that the TRACKING REC CURRENT meter indicates the minimum and maximum parameters. Check all four channels in a similar manner.

h. Remove the retractable microphone from the audio and cue chassis and set the controls to allow voice announcements to be recorded on the cue track.

i. Rotate all four RECORD LEVEL controls fully ccw and note the tape timer position. Slowly advance the CH1 RECORD LEVEL control cw and announce the position of the control in one-half increments (one, one and one-half, two, etc.). Rotate the control from extreme ccw to extreme cw and back to the extreme ccw position.

j. Repeat step i for each of the four RECORD LEVEL controls. Return each control to the ccw position.

k. Rewind the tape to the position noted in step i. Place the system in the playback mode. Observe the waveform monitor and note the peak indications displayed for each channel. Relate the peak indication with the position of the RECORD LEVEL control announced on the cue channel. If more than one peak indication is noted, use the peak position of lowest record current.

l. Set each RECORD LEVEL control and the memory dial behind it to the position noted in step k.

8-32 Weekly Maintenance Procedures

8-33 HEAD DEMAGNETIZATION. Head demagnetizer 4010820 supplied with the VR1200B

recorder should be used weekly to remove the residual magnetism that accumulates in the rotary video heads and the stationary control track, cue track, and audio track heads.

8-34 Prior to demagnetizing the heads, perform the following procedure:

a. If it has not already been done, cover the demagnetizer pole tips with a small piece of tape; if opaque tape is used, mark the location of the gap.

b. Flip down the hinged plate below the audio and cue head assembly.

c. Clean the heads and tape path (refer to paragraph 8-8).

d. Turn the system power on, and pull out circuit breaker CB11 marked SERVO 135V SUP, from the front panel of the system power supply.

e. Lay the demagnetizer on the floor, as far away from the recorder as possible, and plug the demagnetizer connector into one of the utility outlets on the front panel of the system power supply.

8-35 Video Head Assembly. Demagnetize the video head assembly as follows:

a. Unlatch the vacuum tape guide and swing it down. Position video head no. 1 (yellow dot) for easy access.

b. Pick up the demagnetizer, and move it slowly and evenly toward the head tip. Orient the pole tips of the demagnetizer to straddle the video head gap, and touch the demagnetizer to the head tip.

c. After 3 or 4 sec, move the demagnetizer slowly and evenly away from the head tip. The demagnetizer should be withdrawn in the direction opposite from the direction of approach.

d. Hold the demagnetizer away from the console with one hand, and rotate the video head drum with the other so that the next head tip is accessible.

e. Repeat steps b, c, and d for each of the three remaining head tips.

f. Lay the demagnetizer on the floor, and latch the vacuum guide.

g. Pick up the demagnetizer, and move it slowly and evenly toward the control track head mounted on the video head assembly. Orient the demagnetizer pole tips to straddle the control track head gap.

h. Hold the demagnetizer to the control track head for about 15 sec; during this period, slowly move the demagnetizer up and down the length of the head gap.

i. Withdraw the demagnetizer slowly and evenly in the direction opposite from the direction of approach.

8-36 Audio and Cue Heads. Using the techniques of steps g through i of paragraph 8-35, demagnetize the cue read head in the non-scratch erase head assembly, and the audio and cue record/playback heads in the audio and cue head assembly.

8-37 When the entire demagnetization procedure has been performed, withdraw the demagnetizer as far from the recorder as possible and lay it on the floor, then disconnect the power. The SERVO 135V SUP breaker should be reset at this time.

8-38 FILTER CLEANING. It is imperative that the filters in the VR-1200B air and vacuum systems be kept clean, and be replaced when necessary. If filters are allowed to become clogged, air flow will be impeded and unsatisfactory performance or damage to system components may result; if the filters are damaged, they will not filter efficiently, and the results may be the same.

NOTE

Do not use any type of filter coating on these filters.

8-39 The system power must be off, and the bearing air and vacuum gages must be at zero before work is started.

8-40 The recorder rear panel must be removed to perform these procedures, but it is not necessary to remove any chassis to gain access to the filters.

8-41 Power Supply Filter. Service the power supply filter as follows:

a. Locate the power supply filter under the system power supply.

b. Insert a small screwdriver or a similar tool into the left side of the filter (viewed from the front), and push to the left. The right side of the filter may then be pulled down, and the filter removed.

c. Wash the power supply filter in warm water and soap, and dry it.

d. Inspect the filter for damage.

e. Re-install the power supply filter.

8-42 Cooling Fan Panel Filters. The two cooling fan panel filters should be serviced weekly (and must be replaced on a monthly basis with Ampex 52119 filters):

a. Locate the filters under the cooling fan panel.

b. Slide out and remove the filters.

c. Clean the filters by brushing off the collected dirt or by blowing compressed air through the filter.

d. Inspect the filters for damage.

e. Re-install the filters.

8-43 Head Blower Filter. Service the head blower filter as follows:

a. Locate the head blower and release the three catches at the front.

b. Remove the head blower filter.

c. Wash the head blower filter in warm water and soap, and dry it thoroughly.

d. Inspect the filter for damage.

e. Re-install the head blower filter and close the head blower catches.

8-44 Bearing Air Filter. Service the bearing air filter as follows:

a. Locate the bearing air filter bowl and release the snap catch at the top.

b. Pull the filter bowl straight down and remove the bronze filter.

c. Clean the inside of the filter bowl.

WARNING

METHYL ALCOHOL IS HIGHLY FLAMMABLE, BOTH IN LIQUID AND IN VAPOR FORM. DO NOT USE THIS SOLVENT NEAR FIRE OR FLAME, OR WHILE SMOKING.

d. Clean the bronze filter in methyl alcohol, and allow it to dry.

e. Inspect the filter for damage.

f. Re-install the filter and assemble the filter bowl.

8-45 Vacuum System Filters. The vacuum system includes two identical filters and two identical mufflers (see Figure 4-7); the felt filters in these units must be removed and cleaned, and replaced when necessary:

a. Unscrew the filter and muffler glass jars from the vacuum pump assembly.

b. Unscrew the center post from one of the filters, and remove the two felt inserts.

WARNING

METHYL ALCOHOL IS HIGHLY FLAMMABLE, BOTH IN LIQUID AND IN VAPOR FORM. DO NOT USE THIS SOLVENT NEAR FIRE OR FLAME, OR WHILE SMOKING.

c. Wash the felt inserts in methyl alcohol, and allow them to dry.

d. Re-install the felt inserts, and screw the center post and glass jar onto the filter base.

e. Repeat steps c and d for the remaining three filters.

8-46 Bearing Air Compressor Filters. The bearing air compressor filters should be cleaned weekly in accordance with the manufacturer's recommendations in Appendix B of this manual.

8-47 WEEKLY INTERSYNC SERVO CHECKS. The procedure for checking the Intersync servo system is as follows:

a. Determine that the system power is on, and that the external reference sync generator is on and connected to recorder. Allow sufficient time for both units to stabilize.

b. Set the SERVO MODE selector to PRESET; set both PRESET REFERENCE SELECTORs to EXT. Set the SPEED control to 15 ips.

c. Set the WAVEFORM MONITOR selector to REF SYNC; the waveform monitor display must be stable and show no tendency to drift. If the display is not stable, refer to the separate manual for the waveform monitor.

d. Set the WAVEFORM MONITOR selector to DRUM OSC; if the drift exceeds ±1 Hz, the DRUM OSC FREQ control should be adjusted for a display of eight stationary cycles:

1. 525-line standards: adjust R21 DRUM OSC FREQ 525 on MODULE 6.

2. 625-line standards: adjust R20 DRUM OSC FREQ 405/625/819 on module 6.

e. Press the READY pushbutton.

f. Set the WAVEFORM MONITOR selector to CAPSTAN OSC; if the drift exceeds ±1 Hz, the CAPSTAN OSC FREQ control should be adjusted for a display of eight stationary cycles:

1. 525-line standards: adjust R20 CAPSTAN OSC FREQ 525 on module 13

2. 625-line standards: adjust R78 CAPSTAN OSC FREQ 405/625/819 on module 13.

g. Set the VIDEO MONITOR selector to STABILITY MKR, and initiate the record mode.

h. Set the video monitor for a pulse-cross display; adjust the display brightness as necessary in order to see the equalization pulse and stability dot. The spacing between the stability dot and the leading edge of the equalization pulse must be as shown in Figure 8-2.

i. If necessary, adjust the TACH PHASE ADJ control to position the stability dot correctly:

1. 525-line standards: adjust R84 TACH PHASE ADJ 525 on module 3

2. 625-line standards: adjust R1 TACH PHASE ADJ 405/625/819 on module 3.

j. Set the SERVO MODE selector to AUTO, and play back a recording made to SMPTE (or CCIR) standards. The VERT LOCK and HORIZ

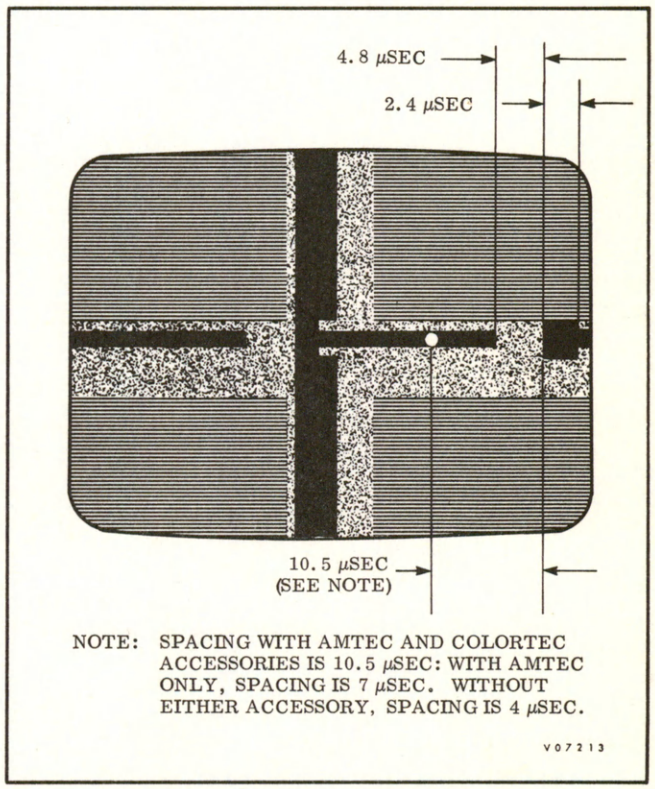


Figure 8-2. Stability Marker Position

LOCK indicators should be lighted. Failure to light is indicative of a servo system malfunction; refer to Intersync manual 1809927 for corrective adjustment procedures.

k. Set the WAVEFORM MONITOR selector to DRUM ERROR and adjust the two HORIZONTAL STABILITY controls for the least error signal.

l. Stop the tape transport, and set the SERVO MODE selector to AUTO.

m. The recorder should still be in the ready mode; if it is not, press the READY pushbutton.

n. Press the PLAY pushbutton and measure the time required for the recorder to lock. The lock-in time should not exceed 4 sec for 525-line standards or 5 sec for 625-line standards.

o. If excessive lock-in time is required, the following possible causes should be checked:

1. Tape recorded at 15 ips with a 5 mil video head

2. Tape slippage at the capstan idler due to improper transport tension adjustments (refer to paragraph 8-63 for adjustment procedures)

3. Improper tape speed due to slippage of the capstan belt (refer to paragraph 8-100 for adjustment procedures)

4. TRACKING control not adjusted for peak rf output

5. Loss of vertical or equalizing pulses (or presence of spurious pulses) in the vertical blanking region of reference sync or tape sync

6. Servo system malfunction (refer to Intersync manual 1809927 for maintenance and corrective adjustment procedures).

8-48 Monthly Maintenance Procedures

8-49 FILTER REPLACEMENT. The two air filters in the cooling fan panel must be replaced monthly with Ampex 52119 filters.

a. Locate the filters under the cooling fan panel.

b. Slide out and remove the filters.

c. Clean the filter holders with a dry rag.

NOTE

Do not use any type of filter coating on these filters.

d. Install the new filters.

8-50 MODULATOR FREQUENCY CHECK. The carrier frequency of the modulator should be checked monthly or when recording quality shows signs of deterioration. If an AFC accessory is used, refer to manual 1809965.

a. Set up the video recorder for recording; use only new or degaussed tape.

b. Set the signal system standards selector to the 525 COLOR position and set the modulator VIDEO GAIN control to its maximum ccw position.

c. Using a calibrated oscilloscope, frequency meter, frequency counter, or other suitable means (e.g., an accurately calibrated receiver) determine that the carrier at the RF test point on the record amplifier module (see Figure 3-4) is at 5.6 MHz.

NOTE

The 525 color standard is selected because this standard is most critical of carrier frequency. With the modulator properly adjusted in this standard other standards will be within tolerance. Setting the modulator carrier at 5.6 MHz without a video signal will result in a sync tip frequency of 5.5 MHz with a normal video signal.

d. If necessary, adjust the carrier frequency control on the front panel of the modulator (item 5, Figure 3-4) for 5.6 MHz.

8-51 AUDIO AND CUE SYSTEM PERFORMANCE CHECK. Before checking the audio and cue system performance, the tape path and heads should be cleaned and the heads demagnetized (refer to paragraph 8-33). This procedure requires the use of a 600 ohm audio oscillator (Hewlett-Packard 200AB or equivalent) and an audio voltmeter (Hewlett-Packard 400H or equivalent).

a. Turn on the system power, and thread the head alignment tape supplied with the recorder on the tape transport. Set the TIP PROJ control fully ccw, to reduce video head-tip engagement to a minimum.

b. Determine that the tape SPEED control is set at 15 ips.

c. If the audio line is not terminated by a 500 or 600 ohm load, connect a 600 ohm non-inductive resistor between pins 2 and 3 of the AUDIO OUT connector on the VR-1200B external connector panel.

d. Turn the P.B. LEVEL control on the audio and cue chassis fully ccw to UNITY and set the METER switch to AUDIO.

e. Press the PLAY pushbutton. The AUDIO meter should read 0 VU (100%). If it does not, perform step f.

f. Adjust R33 (playback gain control) on the audio playback card for 0 VU (see Figure 8-3).

g. Rewind and remove the head alignment tape; thread a roll of new or degaussed tape on the transport.

h. Connect the output of a 600 ohm audio oscillator to an audio voltmeter and to pins 2 and 3 of the AUDIO IN connector on the external connector panel; the test equipment chassis may be grounded to pin 1 or to the frame of the recorder.

i. Set the oscillator frequency to 400 Hz at a level of +8 dBm (1.95 Vrms).

j. Turn the audio RECORD LEVEL control fully ccw to UNITY.

k. Press the AUDIO ONLY REC and the PLAY pushbuttons to initiate the audio only record mode; note the tape timer position.

l. The AUDIO meter should read 0 VU. After approximately 15 sec of recording, stop the tape transport and rewind the tape to the position noted in step k.

m. Play back the recording; the AUDIO meter should read 0 VU. If it does not, perform steps n and o.

n. If the meter reading in step m was low, rotate R5 (record level control) on the audio record amplifier card cw; (see Figure 8-3); if the meter reading was too high, rotate the control ccw. Perform steps k through m until the AUDIO meter reads 0 VU during playback.

o. Stop the tape transport and ensure that the recorder is in the e-e mode. Adjust R32 (e-e gain control) on the audio playback amplifier card (see Figure 8-3) for a meter reading of 0 VU.

p. Connect the audio oscillator to pins 2 and 3 of the CUE IN connector on the external connector panel; perform steps g through o. The output frequency should be set to the control track frequency (240 Hz for 525-line video standards, or 250 Hz for 625-line video standards) at a level of +8 dBm (1.95 Vrms).

q. Connect the audio voltmeter to pins 2 and 3 of the CUE OUT connector on the external connector panel.

r. Ensure that the recorder is in the e-e mode; adjust L1 on the notch filter subassembly (see Figure 8-3) for a minimum indication on the audio voltmeter.

8-52 CHECK OF TRANSPORT ADJUSTMENTS. These procedures should be performed in the order in which they are given.

8-53 In order to check the tape transport, the following equipment is required:

a. Dial indicator scale, 0-2 lb (Ampex 650-105, supplied with the recorder)

b. Dial indicator scale, 0-4 lb (Ampex 650-103, supplied with the recorder)

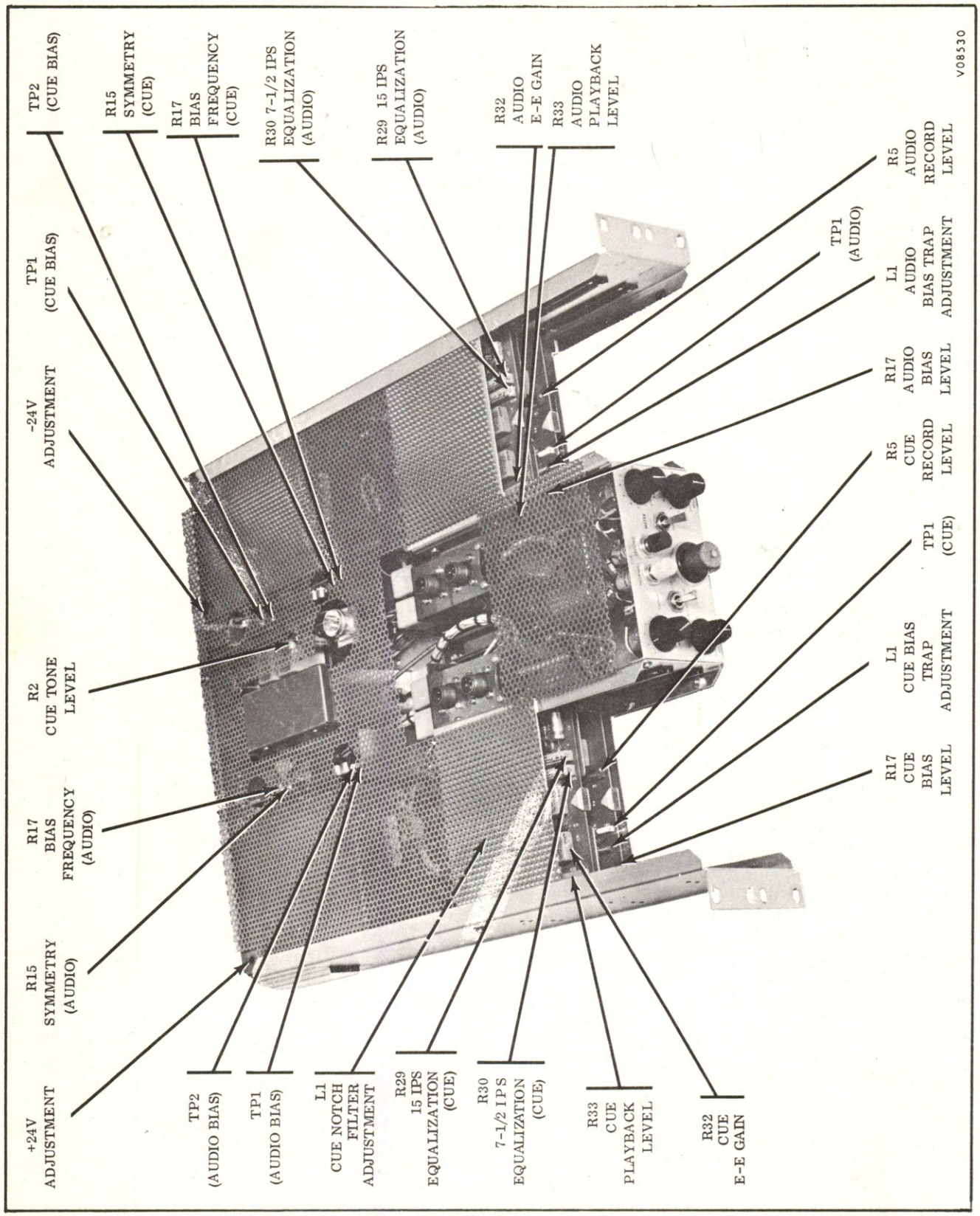


Figure 8-3. Audio and Cue Test and Adjust Points

c. Dial indicator scale, 0-15 lb (Ampex 650-215, supplied with the recorder)

d. Pressure measurement attachment (Ampex 1360943, supplied with the recorder)

e. A 4-ft length of nylon cord with a 1- to 2-in. loop in each end

f. A 3-in. length of 2-in. magnetic recording tape.

8-54 Before making any measurement with a dial indicator scale, hold each scale in the position in which it is to be used to determine its true zero reading. Any deviation must be taken into account when measurements are made.

8-55 Preliminary Steps. The following steps should be performed prior to making the actual transport tension checks and adjustments:

a. Swing the left compliance arm fully to the left, and fasten it in that position with masking tape or other suitable means.

b. Remove the rear panel and the left side panel of the recorder (as viewed from the rear). The side panel is secured to the recorder frame with two wing-screws, removable from the inside of the recorder.

NOTE

This step is necessary in order to gain access to the test and adjustment points on the rear of the system control unit (see Figure 2-1 and Figure 8-4).

WARNING

BEFORE MAKING ANY TENSION ADJUSTMENTS, TURN OFF THE SYSTEM POWER. LETHAL LINE VOLTAGE MAY BE PRESENT AT THE ADJUSTMENT POINTS.

c. Place a jumper across resistor R7003 on the rear of the system control unit (see Figure 8-4). This jumper should be across the whole resistor, not just between one end and the tap.

d. Turn on the system power.

8-56 Boost Torque. The following steps should be performed to check the boost torque which is normally present for the first 1.5 seconds of running time in the play or record mode:

a. Place one end of the nylon cord through the reel guide on the hub of the takeup reel turntable (see Figure 4-4). Feed one of the loops in the nylon cord through the other in order to fasten the cord to the reel guide. Wrap 2 or 3 turns of the cord cw around the reel hub, and fasten the hook of the 0-4 lb scale to the remaining cord loop.

b. Hold the scale parallel to the floor, away from the tape transport; the nylon cord should be taut.

c. Press the PLAY pushbutton; as the cord is wound onto the reel hub, allow the scale to follow. Keep the cord at the tension that just balances the boost torque.

d. Repeat step c until several readings of the same value have been made; in each case, the scale should indicate 56 to 58 oz of tension. If the reading is not within these limits, perform step e.

WARNING

TURN OFF THE SYSTEM POWER BEFORE MAKING ANY ADJUSTMENTS. LETHAL LINE VOLTAGE MAY BE PRESENT AT THE AJDUSTMENT POINT.

e. Adjust resistor R7002 on the rear of the system control unit (see Figure 8-4), then repeat step d.

f. Remove the jumper from resistor R7003 (applied in step c of paragraph 8-55).

g. Do not remove any of the measuring equipment until the procedures of paragraph 8-57 have been performed.

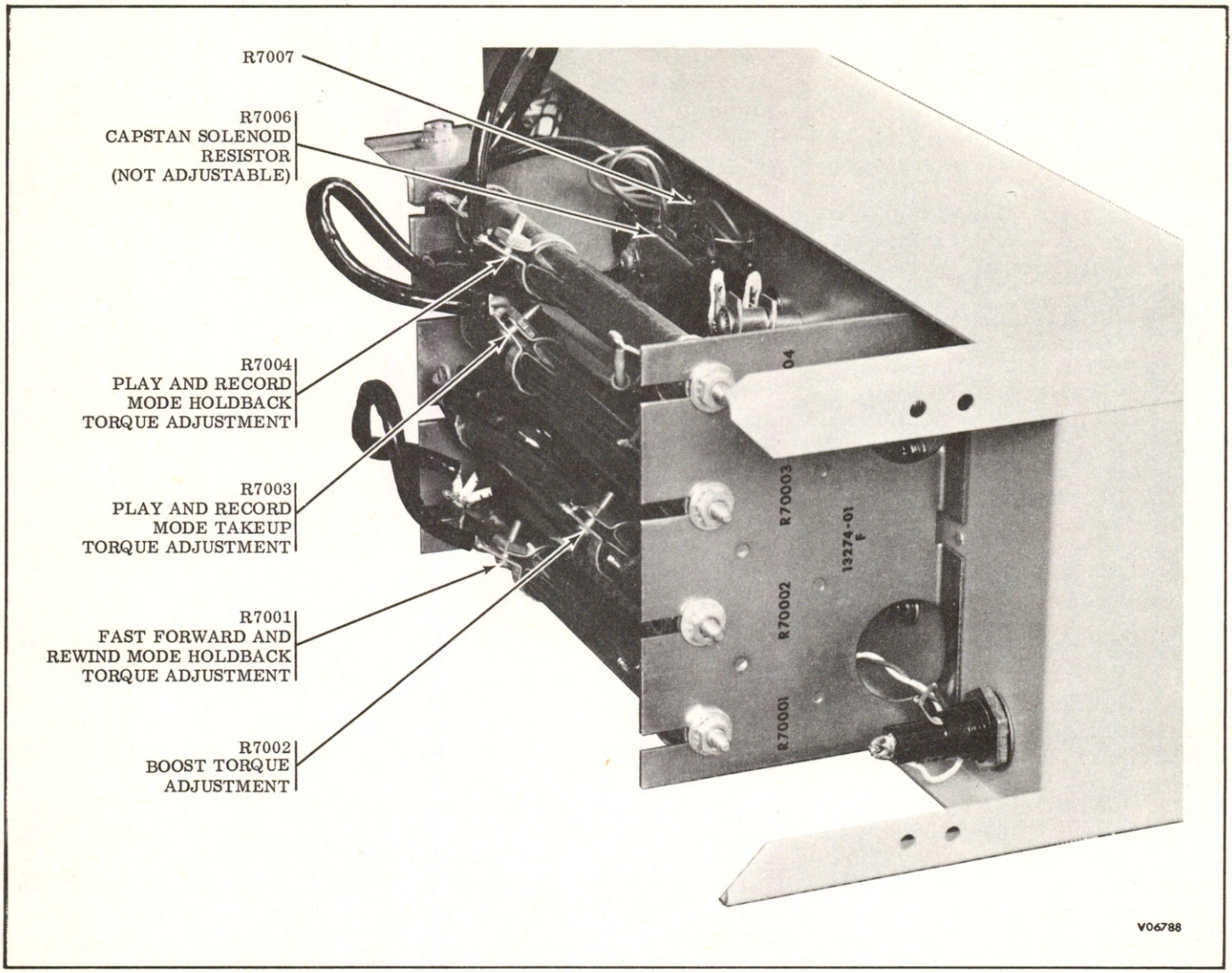


Figure 8-4. Transport Adjustments

8-57 Play Mode Takeup Torque. The following steps should be performed to check the torque of the takeup turntable in the play or record mode:

a. Hold the scale parallel to the floor, away from the tape transport; the nylon cord should be taut.

b. Press the PLAY pushbutton; as the cord is wound onto the reel hub, allow the scale to follow. Keep the cord at the tension that just balances the playback torque. After the boost torque drops out (1.5 sec), read the scale.

c. Repeat step b until several readings of the same value have been made; in each case, the scale should indicate 24 to 26 oz of tension. If the reading is not within these limits, perform step d.

WARNING

TURN OFF THE SYSTEM POWER BEFORE MAKING ANY ADJUSTMENTS. LETHAL LINE VOLTAGE MAY BE PRESENT AT THE ADJUSTMENT POINT.

d. Adjust resistor R7003 on the rear of the system control unit (see Figure 8-4), then repeat step c.

e. Remove the 0-4 lb scale, but do not remove the nylon cord until the procedures of paragraph 8-58 been performed.

8-58 Rewind Holdback Torque. The following steps should be performed to check the holdback tension on the takeup reel when the recorder is in the rewind mode:

a. Fasten the hook of the 0-2 lb scale to the nylon cord loop.

b. Hold the scale parallel to the floor, away from the tape transport; the nylon cord should be taut.

c. Press the REWIND pushbutton; as the cord is wound onto the reel hub, allow the scale to follow. Keep the cord at the tension that just balances the holdback torque.

d. Repeat step c until several readings of the same value have been made; in each case, the scale should indicate 8 to 9 oz of tension. If the reading is not within these limits, perform step e.

WARNING

TURN OFF THE SYSTEM POWER BEFORE MAKING ANY ADJUSTMENTS. LETHAL LINE VOLTAGE MAY BE PRESENT AT THE ADJUSTMENT POINT.

e. Adjust resistor R7001 on the rear of the system control unit (see Figure 8-4), then repeat step d.

8-59 Takeup Reel Braking Force. The following steps should be performed to check the braking force on the takeup reel when the recorder has been stopped:

a. Wrap the entire length of the nylon cord ccw around the reel hub, and fasten the hook of the 0-2 lb scale to the cord loop.

b. Hold the scale parallel to the floor, as close to the reel hub as possible.

c. Pull the scale to unwind the cord from the reel hub (the take-up turntable will rotate ccw).

d. When the cord is being pulled from the hub at a steady rate, read the scale tension.

e. Repeat step d until several readings of the same value have been made; in each case, the scale should indicate 20 to 28 oz of tension. If the reading is not within these limits, perform step f.

f. Turn the nut on the takeup reel brake assembly (see Figure 8-5) to adjust the tension (cw to increase tension), then repeat step e.

g. Wrap the entire length of the cord cw around the reel hub, and fasten the spring hook of the 0-15 lb scale to the cord loop.

h. Hold the scale parallel to the floor, as close to the reel hub as possible.

i. Pull the scale to unwind the cord from the reel hub (the takeup turntable will rotate cw).

j. When the cord is being pulled from the hub at a steady rate, read the scale tension.

k. Repeat step j until several readings of the same value have been made; in each case, the scale should indicate 7 to 8 lb of tension. If the reading is not within these limits, perform step l.

l. Turn the nuts on either side of the brake solenoid (see Figure 8-5) to adjust the tension (cw to increase tension), then repeat step k.

NOTE

Brake tension is increased by increasing the tension on two springs associated with the brake solenoid. Both springs must be loaded to the same tension; if the indicated tension varies while the cord is being pulled at a steady rate, the spring tensions may be unequal.

m. Remove the scale and the nylon cord from the takeup reel hub.

8-60 Play Mode Holdback Torque. The following steps should be performed to check

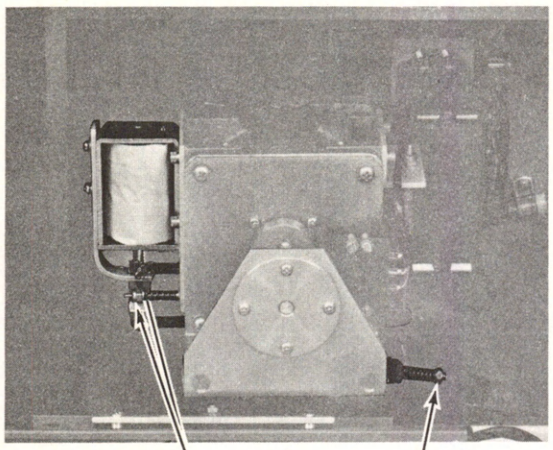


Figure 8-5. Takeup Reel Brake Assembly

the holdback tension on the supply reel when the recorder is in the play or record mode:

a. Place one end of the nylon cord through the reel guide on the supply reel turntable (see Figure 4-4). Feed one of the loops in the cord through the other in order to fasten the cord to the reel guide. Wrap 2 or 3 turns of the cord ccw around the reel hub, and hook the 0-2 lb scale to the remaining cord loop.

b. Hold the scale parallel to the floor, away from the tape transport; the nylon cord should be taut.

c. Press the PLAY pushbutton; as the cord is wound onto the reel hub, allow the scale to follow. Keep the cord at the tension that just balances the holdback torque.

d. Repeat step c until several readings of the same value have been made; in each case, the scale should indicate 9 to 12 oz of tension. If the reading is not within these limits, repeat step e.

WARNING

BEFORE MAKING ANY TENSION ADJUSTMENTS, TURN OFF THE SYSTEM POWER. LETHAL LINE VOLTAGE MAY BE PRESENT AT THE ADJUSTMENT POINTS.

e. Adjust resistor R7004 on the rear of the system control unit (see Figure 8-4), then perform step d.

f. Do not remove any of the measuring equipment until the procedures in paragraph 8-61 have been performed.

8-61 Fast Forward Holdback Torque. The following steps should be performed to check the holdback tension on the supply reel when the recorder is in the fast forward mode:

a. Hold the scale parallel to the floor, away from the tape transport; the nylon cord should be taut.

b. Press the FAST FWD pushbutton; as the cord is wound onto the reel hub, allow the scale to follow. Keep the cord at the tension that just balances the holdback torque.

c. Repeat step b until several readings of the same value have been made; in each case the scale should indicate 8 to 9 oz of tension. If reading is not within these limits, perform step d.

WARNING

BEFORE MAKING ANY TENSION ADJUSTMENTS, TURN OFF THE SYSTEM POWER. LETHAL LINE VOLTAGE MAY BE PRESENT AT THE ADJUSTMENT POINTS.

d. Adjust resistor R7001 on the rear of the system control unit (see Figure 8-4), then repeat step c.

NOTE

Resistor R7001 is also used to set the rewind mode holdback torque

(refer to paragraph 8-58), and should already be set correctly. If no setting of R7001 will produce the proper holdback tension for both modes, set both as close as possible to the optimum values.

8-62 Supply Reel Braking Force. The following steps should be performed to check the braking force on the supply reel when the recorder has been stopped:

a. Wrap the entire length of the nylon cord cw around the reel hub, and fasten the hook of the 0-2 lb scale to the cord loop.

b. Hold the scale parallel to the floor, as close to the reel hub as possible.

c. Pull the scale to unwind the cord from the reel hub (the takeup turntable will rotate cw).

d. When the cord is being pulled from the hub at a steady rate, read the scale tension.

e. Repeat step d until several readings of the same value have been made; in each case, the scale should indicate 20 to 28 oz of tension. If the reading is not within these limits, perform step f.

f. Turn the nut on the takeup reel brake assembly (see Figure 8-5) to adjust the tension (cw to increase tension), then repeat step e.

g. Wrap the entire length of the cord ccw around the reel hub, and fasten the spring hook of the 0-15 lb scale to the cord loop.

h. Hold the scale parallel to the floor, as close to the reel hub as possible.

i. Pull the scale to unwind the cord from the reel hub (the takeup turntable will rotate ccw).

j. When the cord is being pulled from the hub at a steady rate, read the scale tension.

k. Repeat step j until several readings of the same value have been made; in each case, the scale should indicate 7 to 8 lb of tension. If the reading is not within these limits, perform step l.

l. Turn the nuts on either side of the brake solenoid (see Figure 8-5) to adjust the tension (cw to increase tension), then repeat step k.

NOTE

Brake tension is increased by increasing the tension on two springs associated with the brake solenoid. Both springs must be loaded to the same tension; if the indicated tension varies while the cord is being pulled at a steady rate, the spring tensions may be unequal.

m. Remove the scale and the nylon cord from the takeup reel hub.

8-63 Capstan Idler Pressure. The following steps should be performed to check the pressure of the rotary solenoid which holds the capstan idler against the capstan:

a. Remove the head cover assembly from the tape transport.

b. Install the pressure measurement attachment on the capstan idler yoke.

c. Pull out the braker marked CB11 SERVO 135V SUP on the system power supply front panel; this will prevent the capstan from rotating.

d. Thread the piece of 2-in. magnetic tape through the tape path in the area of the capstan.

e. Attach the 0-15 lb scale to the cord from the pressure measurement attachment.

f. Press the PLAY pushbutton to energize the capstan idler solenoid.

g. Pull straight up on the scale until the tape between the capstan shaft and capstan idler can be moved easily. Re-check this pressure when the transport is warm.

h. Repeat step g until several readings of the same value have been made; in each case the scale should indicate 11 to 12

lb of tension. If the reading is not within these limits, perform step i.

i. Adjust the nut on the end of the solenoid arm (behind the transport) to adjust the tension (cw to increase tension), then repeat step h.

j. Remove the tension measuring equipment from the transport, re-install the head cover assembly and reset breaker CB11.

8-64 MONTHLY INTERSYNC SERVO CHECKS. The procedure for checking the Intersync servo system is as follows:

a. Determine that the system power is on, and that the external reference sync generator is on and connected to the recorder. Allow sufficient time for both units to stabilize. Determine that the READY pushbutton is not lighted.

b. Set the SERVO MODE selector to PRESET; set both PRESET REFERENCE SELECTORs to EXT. Set the SPEED control to 15 ips.

c. Press the READY pushbutton.

d. Set the DISCR selector on the servo meter panel to REF. The meter should read within the uncolored area.

NOTE

This measurement may also be made at test point TP4 on module 2. The dc level as read on a 10 megohm or higher dc voltmeter should not exceed +0.5 or -1.0V.

e. If the reading is not within limits, make the following adjustment:

1. 525-line standards: adjust R28 on module 2 for a null.

2. 625-line standards: adjust R29 on module 2 for a null.

f. Set the DISCR selector to TACH. The meter should read within the uncolored area.

NOTE

This measurement may also be made at test point TP3 on module 3. The dc level as read on a 10 megohm or higher dc voltmeter should not exceed +0.5V.

g. If the reading is not within limits, make the following adjustment:

1. 525-line standards: adjust R61 on module 3 for a null.

2. 625-line standards: adjust R62 on module 3 for a null.

h. Set the DISCR selector to CAPST. The meter should read within the uncolored area.

NOTE

This measurement may also be made at test point TP3 on module 12. The dc level as read on a 10 megohm or higher dc voltmeter should not exceed ±0.5V.

i. If the reading is not within limits, make the following adjustment:

1. 525-line standards: adjust R1 on module 12 for a null.

2. 625-line standards: adjust R2 on module 12 for a null.

j. Press the READY pushbutton.

k. Set the SERVO MODE selector to VERT, and play back a recording made to SMPTE (or CCIR) standards.

l. After lock-in, the VERT LOCK indicator should be lighted steadily, and show no tendency to flicker. If necessary, adjust R72 VERTICAL LOCK PHASE on module 1 to the mid-point of the range where the VERT LOCK indicator is lighted.

8-65 Annual Maintenance Procedure

Although not required for proper operation, lubrication will extend the life of the cooling fans considerably; Ampex kit 591-069 (supplied with the recorder) includes the required lubricant, syrenge, and instructions for fan lubrication.

8-66 5000-Hour Maintenance Procedure

The bearing air compressor should be overhauled every 5000 hours of use or when decreasing pressure (as measured by compressor pressure test kit 800-787, available from Ampex) indicates the need. This overhaul may be done by the manufacturer, by Ampex, or by the user. Ampex kit 1230946 contains the materials required to overhaul the compressor; instructions are contained in Field Engineering Bulletin 60180, sheet G806-1 (24 June 1968).

8-67 CORRECTIVE MAINTENANCE

8-68 Corrective Adjustment Procedures

8-69 SIGNAL SYSTEM TACHOMETER PHASING. If switching holes appear on the picture monitor(s) at the recorder output, the tachometer phasing of the switching logic module requires adjustment:

a. Remove the sync processing module (module 12) from the signal system chassis.

b. Turn on system power.

c. Play back a good quality recording and observe the picture monitor.

d. Adjust the tach phasing control (item 12, Figure 3-4; reached through a hole in the front panel of the switcher logic module) ccw until switching holes are clearly evident (disregard diagonal rows of dots).

e. Turn the control cw until the switching holes disappear and the picture clears; turn the control one more complete turn cw.

f. Re-install the sync processing module.

8-70 GUIDE POSITION ERROR. If playback skewing errors are observed on picture monitor(s) when the recorder is in the automatic mode of vacuum guide control, the guide error zero reference must be adjusted:

a. Remove the front panel overlay from the sync processing module (signal system module 12); this is accomplished by removing the three Phillips-head screws from the front panel and loosening the two large slotted screws.

b. While playing back a reference tape, adjust the guide servo in the manual mode for proper vacuum-guide position (TIP PROJ control at the reference level, guide-height adjusting screw in the automatic compensator arm set at the position which eliminates picture skewing). Refer to the appropriate instructions in guide servo kit instruction manual 1809974.

c. Switch from manual to automatic guide servo control.

NOTE

In the following step, it is important that only R73 (top control) be adjusted; it is suggested that, in order to prevent inadvertent misadjustment of any other control, a piece of tape be placed over the access hole to R74, R75, and R76.

d. Adjust R73 until picture skewing is no longer evident.

e. Switch to manual mode, then back to automatic mode; re-adjust R73 if necessary.

f. Replace the module 12 front panel overlay.

8-71 AUDIO AND CUE SYSTEM ADJUSTMENTS. The following audio and cue system adjustments need be performed only if an increase in audio or cue channel noise or distortion is noted; if a malfunction is caused by defective components, these components must be replaced before the procedures are performed.

8-72 The following test equipment and components are required to perform these procedures:

a. Audio oscillator, 600 ohm (Hewlett-Packard 200AB or equivalent).

b. Audio volt/dB meter (Hewlett-Packard 400H or equivalent).

c. General-purpose triggered oscilloscope (Tektronix 530-, 540-, or 560-series or equivalent).

d. 1000:1 resistive pad as shown in Figure 8-6.

e. Two resistors, 600 ohm, 0.5 watt, non-inductive.

f. Resistor, 1000 ohm, 0.5 watt, non-inductive.

g. Capacitor, 0.1 UF (±10%), 600 volt.

8-73 The following equipment is desirable, but not essential to the performance of these procedures:

a. Balanced audio volt/dB meter (Hewlett-Packard 403B or equivalent); used in place of item b of paragraph 8-72.

b. Wave analyzer (Hewlett-Packard 302A or equivalent); replaces item b of paragraph 8-72 or item a of this paragraph.

8-74 Preliminary Procedures. Prior to performing the actual audio and cue system adjustments, the following actions must be accomplished:

a. Remove the rear panel of the VR-1200B.

b. Turn on the system power.

c. Set the TIP PROJ mode selector to MAN, and turn the TIP PROJ control fully ccw (minimum head tip engagement).

d. Determine that the transport SPEED switch is set to 15 ips.

e. Thoroughly clean and demagnetize the entire tape path, in accordance with the instructions in paragraph 8-33.

f. Load and thread a roll of new or degaussed tape on the tape transport.

NOTE

The audio channel record/playback head has a gap of 0.00025 in. (1/4 mil); the cue channel head has a gap of 0.0005 in. (1/2 mil). The head characteristics are therefore somewhat different. If it is desired that the cue channel cards be available as ready spares for the audio channel, the cue channel cards must be set up while plugged into the audio channel receptacles.

8-75 Audio Channel Record Bias Optimization. The following procedure describes

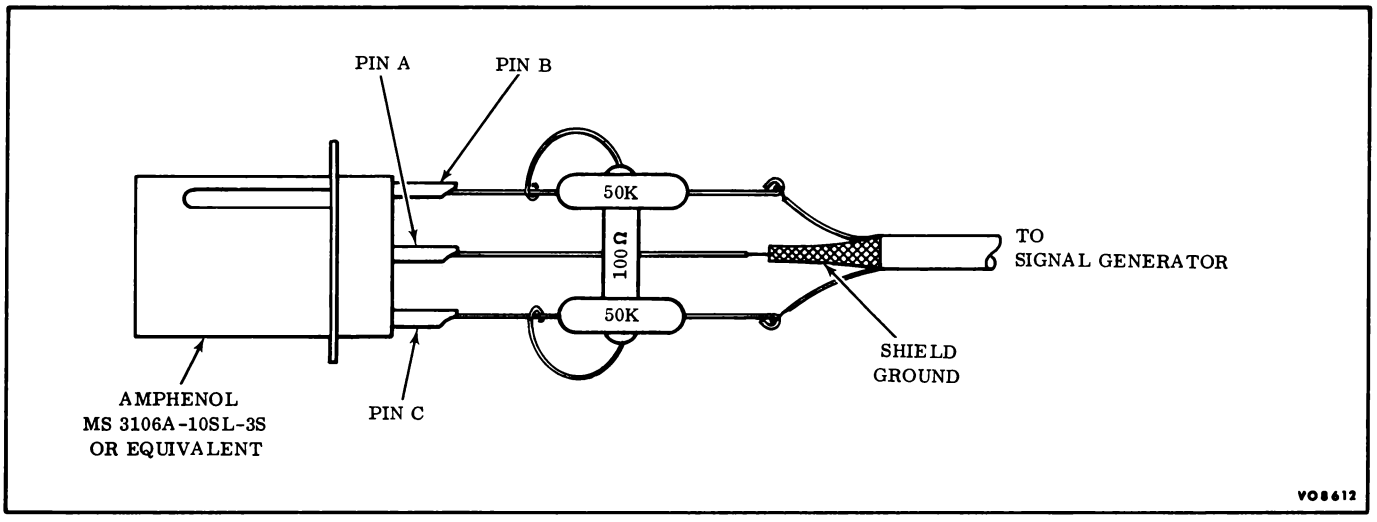
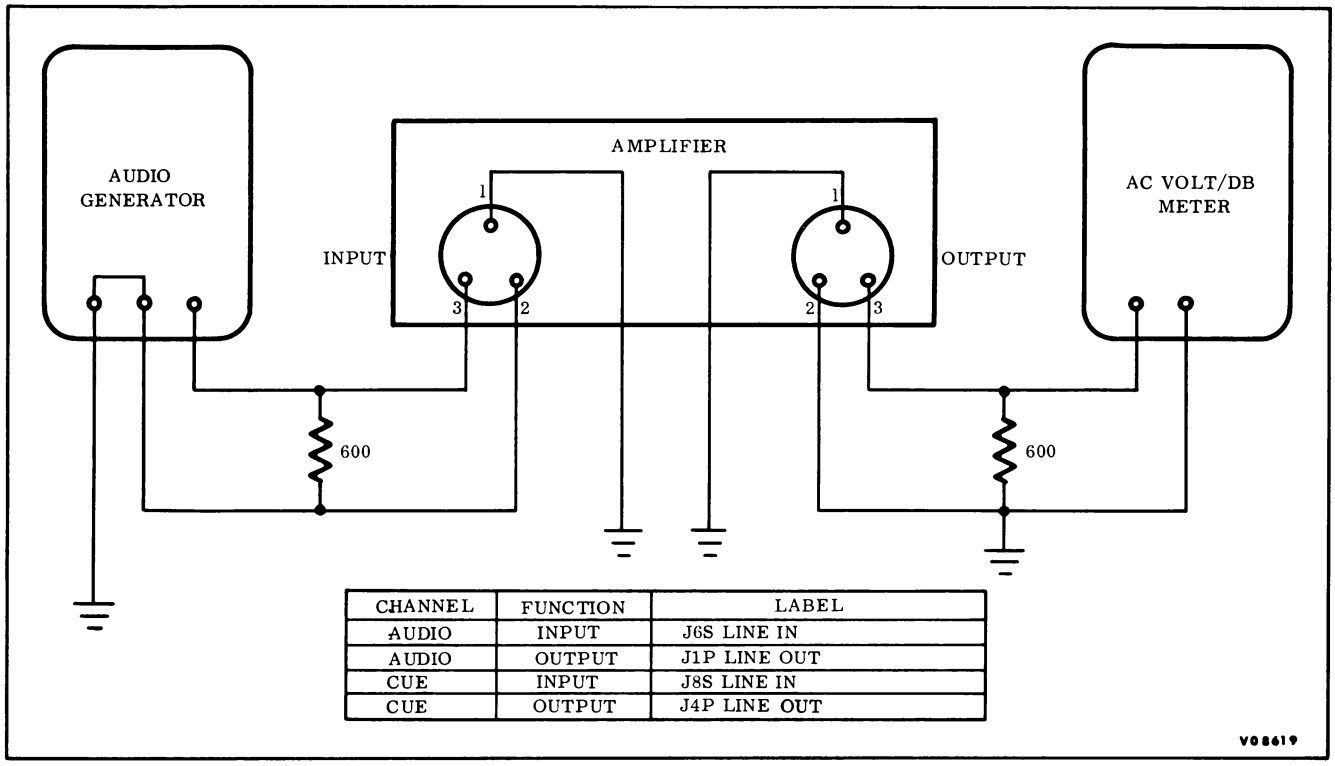


Figure 8-6. 1000:1 Pad Construction Details



CHANNEL	FUNCTION	LABEL
AUDIO	INPUT	J6S LINE IN
AUDIO	OUTPUT	J1P LINE OUT
CUE	INPUT	J8S LINE IN
CUE	OUTPUT	J4P LINE OUT

Figure 8-7. Test Setup for Record Bias

the steps required to set the recording bias of the audio channel to the optimum value. The Procedure is in two sections. The first gives preliminary steps, the second the actual optimization adjustments.

a. Remove connector J6P from J6S LINE IN on the rear of the audio and chassis. Connect one of the 600 ohm resistors across the output of the audio oscillator, and connect the oscillator to pins 2 and 3 of J6S (see Figure 8-7).

b. Set the generator frequency to 500 Hz and the output level to -2 dBm (0.616 Vrms).

c. Remove connector J1S from J1P LINE OUT on the rear of the audio and cue chassis. Connect the other 600 ohm resistor across the input of the audio meter, and connect the voltmeter to pins 2 and 3 of J1P (see Figure 8-7).

d. Set the meter range to +10 dBm initially (the measurement to be made will be a relative maximum indication).

e. Place the oscilloscope probe in TP1 of the audio bias and erase oscillator card (see Figure 8-3); set the oscilloscope sweep rate to 1 Usec/division.

f. Press the PLAY and REC pushbuttons; the frequency of the bias and erase oscillator should be 100 kHz. If it is not, perform step g.

NOTE

In the following step, it is important that only R17 be adjusted; R15 is factory-adjusted and should not require re-adjustment unless a symmetry-determining component is replaced.

g. Adjust R17 on the audio bias and erase oscillator card (see Figure 8-3), for 100 kHz.

h. Adjust L1 (audio channel bias trap adjustment) for maximum amplitude (i.e., least loading) of the 100 kHz signal on the

oscilloscope display. (The location of L1 is shown in Figure 8-3).

i. Note the tape timer reading, continue recording for 30 seconds, then stop the transport.

j. Play back the recording made in steps f through i and set the METER switch to AUDIO; the AUDIO meter should read 0 vu (100%). If it does not, perform step k.

k. Adjust R5 (audio record level adjustment) while making short recordings to determine the position of R5 that gives a 0 vu playback indication. The location of R5 is shown in Figure 8-3.)

l. Place the oscilloscope probe in TP1 of the audio record amplifier card. Adjust R17 on the audio record amplifier card for a bias level of 15V p-p. (See Figure 8-3.)

8-76 Optimization of bias level consists of making a series of brief recordings, beginning with R17 set as in step l, followed by several higher and lower settings. The position of each successive setting may be noted, or recorded by voice announcement on the cue track. In general, the best bias level is the one that produces the maximum playback level. However, there are other factors to be considered that influence the final choice. For example, a bias level that is too high reduces high frequency response, effective playback level, and distortion; a bias level that is too low also reduces the effective playback level, but increases high frequency response and distortion. The acceptable limits of bias level are those that produce a playback level within 1 dB of the peak. However, the best setting is usually the over-bias level at which audio response is between the peak and -1 dB.

a. Note the tape timer reading and initiate record mode. After 10 sec, turn R17 to reduce the bias level 1V. at 5-sec intervals reduce the bias level in 1V increments to 10V. After 10 sec, increase the bias level to 16V, and then at 5-sec intervals increase the level in 1V increments to 20V.

b. Reproduce the recording and determine the bias level that produces the maximum playback level indication on the AUDIO meter. Adjust bias to this level.

c. Note the tape timer reading. Initiate record mode. After 10 sec reduce the bias level 0.5V; after 5 sec increase it 1V.

d. Reproduce the recording made in step c, and determine the bias level that produces the maximum playback level. Adjust bias to this level.

e. Repeat steps c and d at smaller increments of bias voltage until the maximum playback level of the recording is determined. Select the over-bias level at which the audio response is between the peak and -1 dB. Adjust R17 to this bias level setting, and note this bias level for future reference.

f. Adjust the audio oscillator amplitude to +8 dBm (1.95 Vrms). Make a 10-sec recording and play it back. The AUDIO meter should indicate approximately 0 vu. If the meter indication is other than 0 vu, perform steps g and h.

g. Make a series of short recordings, and adjust R5 on the audio record amplifier card for a 0 vu playback indication.

h. Stop the transport, and make sure the recorder is in the e-e mode. Adjust R32 on the audio playback amplifier card (e-e gain adjustment) until the AUDIO meter indicates 0 vu. (see Figure 8-3.)

8-77 Cue Channel Record Bias Optimization. The following procedure describes the steps required to set the recording bias of the cue channel to the optimum value. The procedure is in two sections. The first gives preliminary steps, the second the actual optimization adjustments.

a. Remove connector J8P from J8S LINE IN on the rear of the audio and cue chassis. Connect one of the 600 ohm resistors across the output of the audio oscillator, and connect the oscillator to pins 2 and 3 of J8S (see Figure 8-7).

b. Set the generator frequency to 500 Hz and the output level to -2 dBm (0.616 Vrms).

c. Remove connector J4S from J4P LINE OUT on the rear of the audio and cue chassis. Connect the other 600 ohm resistor

across the input of the audio voltmeter, and connect the meter to pins 2 and 3 of J4P (see Figure 8-7).

d. Set the meter range to +10 dBm initially (the measurement to be made will be a relative maximum indication).

e. Place the oscilloscope probe in TP1 of the cue bias and erase oscillator card (see Figure 8-3); set the oscilloscope sweep rate to 1 Usec/division.

f. Press the PLAY and REC push-buttons; the frequency of the bias and erase oscillator should be 100 kHz. If it is not, perform step g.

NOTE

In the following step, it is important that only R17 be adjusted; R15 is factory-adjusted and should not require re-adjustment unless a symmetry-determining component is replaced.

g. Adjust R17 on the cue bias and erase oscillator card (see Figure 8-3), for 100 kHz.

h. Adjust L1 (audio channel bias trap adjustment) for maximum amplitude (i.e., least loading) of the 100 kHz signal on the oscilloscope display. (The location of L1 is shown in Figure 8-3).

i. Note the tape timer reading, continue recording for 30 seconds, then stop the transport.

j. Play back the recording made in steps f through l and set the METER switch to CUE; the AUDIO meter should read 0 vu (100%). If it does not, perform step k.

k. Adjust R5 (cue record level adjustment) while making short recordings to determine the position of R5 that gives a 0 vu playback. (The location of R5 is shown in Figure 8-3.)

l. Place the oscilloscope probe in TP1 of the cue record amplifier card. Adjust R17 on the cue record amplifier card for a bias level of 15V p-p. (See Figure 8-3.)

8-78 Optimization of bias level consists of making a series of brief recordings, beginning with R17 set as in step l, followed by several higher and lower settings. The position of each successive setting should be noted. In general the best bias level is the one that produces the maximum playback level. However, there are other factors to be considered that influence the final choice. For example, a bias level that is too high reduces high frequency response, effective playback level, and distortion; a bias level that is too low also reduces the effective play-back level, but increases high frequency response and distortion. The acceptable limits of bias level are those that produce a playback level within 1 dB of the peak. However, the best setting is usually the over-bias level at which audio response is between the peak and -1 dB.

a. Note the tape timer reading and initiate record mode. After 10 sec, turn R17 to reduce the bias level 1V. At 5-sec intervals reduce the bias level in 1V increments to 10V. After 10 sec, increase the bias level to 16V, and then at 5-sec intervals increase the level in 1V increments to 20V.

b. Reproduce the recording and determine the bias level that produces the maximum playback level indication on the AUDIO meter. Adjust bias to this level.

c. Note the tape timer reading. Initiate record mode. After 10 sec reduce the bias level 0.5V; after 5 sec increase it 1V.

d. Reproduce the recording made in step c, and determine the bias level that produces the maximum playback level. Adjust bias to this level.

e. Repeat steps c and d at smaller increments of bias voltage until the maximum playback level of the recording is determined. Select the over-bias level at which the audio response is between the peak and -1 dB. Adjust R17 to this bias level setting, and note this bias level for future reference.

f. Adjust the audio oscillator amplitude to +8 dBm (1.95 Vrms). Make a 10-sec recording and play it back. The AUDIO

meter should indicate approximately 0 vu. If the meter indication is other than 0 vu, perform steps g and h.

g. Make a series of short recordings, and adjust R5 on the cue record amplifier card for a 0 vu playback indication.

h. Stop the transport, and make sure the recorder is in the e-e mode. Adjust R32 on the cue playback amplifier card (e-e gain adjustment) until the AUDIO meter indicates 0 vu. (See Figure 8-3.)

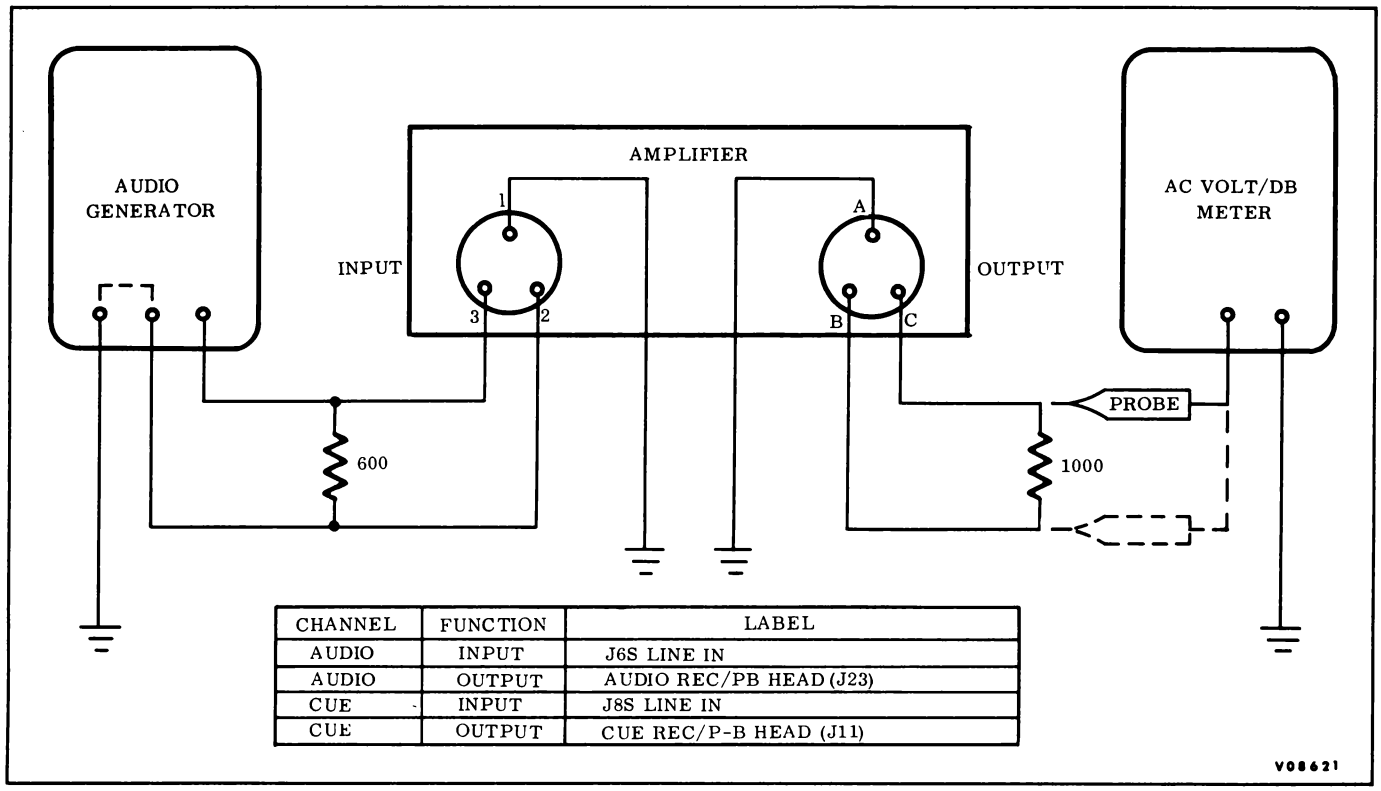
8-79 Check of Record Equalization. The use of an audio voltmeter with balanced input will simplify the performance of this check of record equalization. If such an instrument is available, make the connections shown in Figure 8-8.

8-80 If only the more conventional voltmeter with unbalanced input is available, make the connections shown in Figure 8-9.

8-81 If a voltmeter with balanced input is used, the meter reading is a direct measure of equalization of each tested frequency; if the more conventional voltmeter with unbalanced input is used, the voltage to ground at pin C must be subtracted from the voltage to ground at pin B, for each tested frequency.

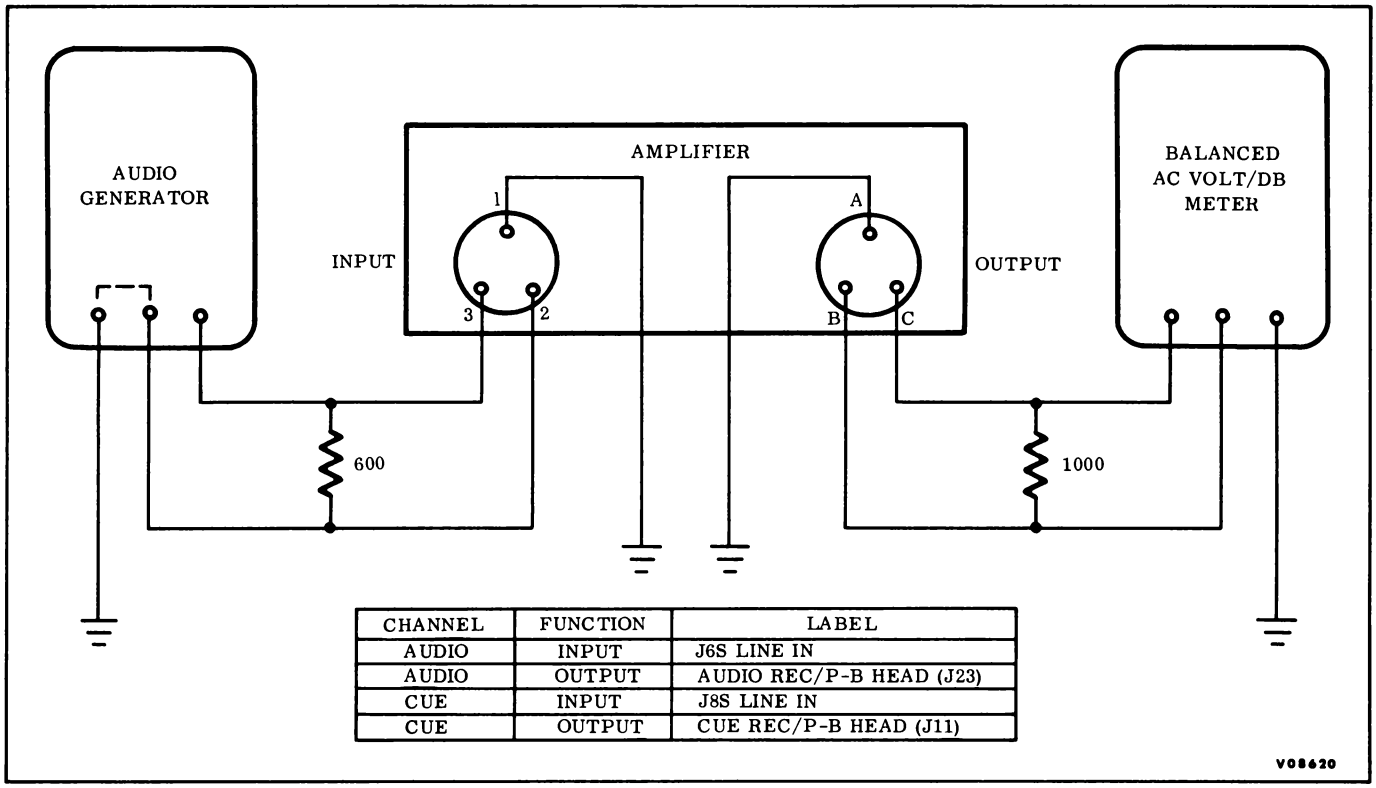
a. Remove the perforated top cover of the audio and cue system, and pull both bias and erase oscillator cards out of their sockets.

b. Set the tape SPEED control to 15 ips. Set the audio RECORD LEVEL control to UNITY. Maintain the output amplitude of the oscillator at +8 dBm (1.95 Vrms) while sweeping the frequencies shown in Table 8-2. With the exception of the 500 Hz reference frequency, the response should be within 1 dB at each frequency listed.



CHANNEL	FUNCTION	LABEL
AUDIO	INPUT	J6S LINE IN
AUDIO	OUTPUT	AUDIO REC/PB HEAD (J23)
CUE	INPUT	J8S LINE IN
CUE	OUTPUT	CUE REC/P-B HEAD (J11)

Figure 8-8. Record Equalization Measurement with Balanced Voltmeter



CHANNEL	FUNCTION	LABEL
AUDIO	INPUT	J6S LINE IN
AUDIO	OUTPUT	AUDIO REC/P-B HEAD (J23)
CUE	INPUT	J8S LINE IN
CUE	OUTPUT	CUE REC/P-B HEAD (J11)

Figure 8-9. Record Equalization Measurement with Unbalanced Voltmeter

Table 8-2. Record Equalization at 15 ips

FREQUENCY	RESPONSE
50 Hz	+3.0 dB
500 Hz	0 dB Reference (0.3 Vrms)
5 kHz	+0.75 dB
10 kHz	+2.5 dB
15 kHz	+4.0 dB

c. Repeat step b with tape speed set at 7-1/2 ips. The response should be shown in Table 8-3 within 1 dB.

Table 8-3. Record Equalization at 7-1/2 ips

FREQUENCY	RESPONSE
50 Hz	+3.0 dB
500 Hz	0 dB Reference (0.3 Vrms)
5 kHz	+5 dB
10 kHz	+8.5 dB
15 kHz	+9.5 dB

d. Temporarily replace the audio record amplifier etched board with its cue channel counterpart and repeat steps b and c.

The resulting measurements should be essentially similar to those of the audio cards.

e. Restore the cue channel cards and the audio channel cards to their respective receptacles.

f. Plug the bias and erase oscillator cards back in, and replace the perforated top cover.

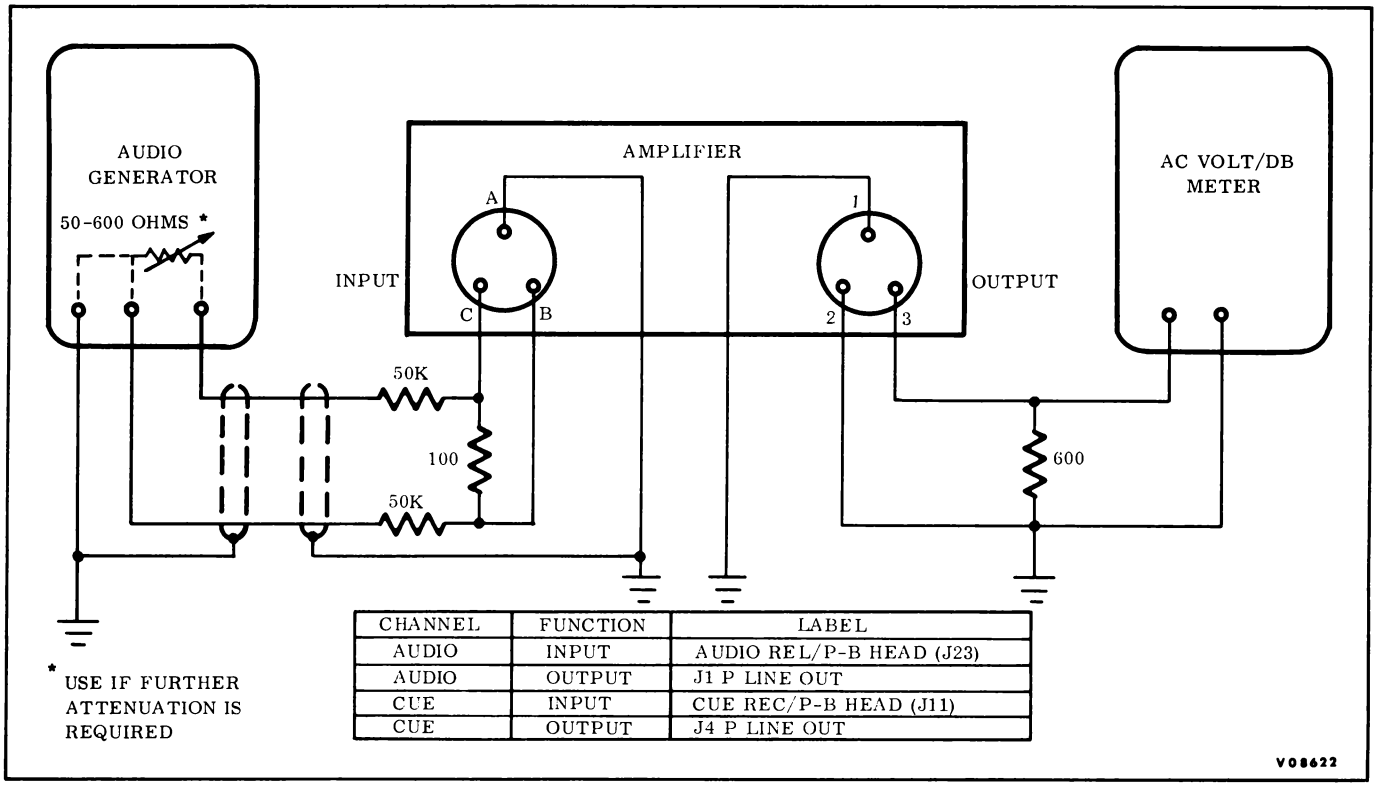
8-82 Check of Playback Equalization. The following procedure is primarily a confirmation that the audio playback amplifier response is normal. In order that the cue playback amplifier may serve as a true spare (in terms of gain) for its audio counterpart, its playback equalization should also be checked and adjusted by the same procedure while it is physically placed in the receptacle of the audio playback amplifier.

a. Remove the harness connector from the AUDIO REC/P-B HEAD receptacle. Remove the harness connector from J1P LINE OUT.

b. Connect the audio oscillator output through the 1000:1 pad to pins B and C of the AUDIO REC/P-B HEAD receptacle; shunt the audio voltmeter input with one of the 600 ohm resistors and connect it to pins 2 and 3 of J1P LINE OUT. (See Figure 8-10.)

c. Determine that tape speed is set at 15 ips. Set the audio P.B. LEVEL control to UNITY and set the METER switch to AUDIO. Set the audio oscillator frequency to 500 Hz and adjust its output level so the voltmeter indicates 0 dBm (0.775 Vrms) at the output of the audio channel. Measure the signal level at the output terminals of the audio generator. The measured level should be 0.J Vrms. If necessary, shunt the audio oscillator as shown in Figure 8-10.

d. Maintain the output level of the audio generator at the level determined in step c while sweeping the frequencies shown in Table 8-4. The response should be within 1 dB at 50 Hz, 5 kHz, and 15 kHz.



CHANNEL	FUNCTION	LABEL
AUDIO	INPUT	AUDIO REL/P-B HEAD (J23)
AUDIO	OUTPUT	J1 P LINE OUT
CUE	INPUT	CUE REC/P-B HEAD (J11)
CUE	OUTPUT	J4 P LINE OUT

Figure 8-10. Playback Equalization Measurement

Table 8-4 Playback Response

FREQUENCY	RESPONSE
50 Hz	+14.5 dB
500 Hz	0 dBm reference
5 kHz	-16.0 dB
10 kHz	-20.0 dB
15 kHz	-22.5 dB

e. If necessary, adjust R29 on the playback amplifier card for -20.0 dB at 10 kHz.

f. Set tape speed to 7-1/2 ips, then repeat step d. Adjust R30 on the playback amplifier card for a response of -20.0 dB at 10 kHz.

g. Re-attach the connectors removed in step a.

h. Exchange the audio and cue playback amplifier cards, and repeat this procedure.

8-83 After the cue card response has been measured and the equalization adjusted it should be returned to its own receptacle.

8-84 Audio Channel Record Noise Balance. The adjustment of record noise balance is usually unnecessary until a symmetry-determining component of the audio bias and erase oscillator card is replaced. Magnetized elements of, or adjacent to, the tape path may cause second harmonics of the signal frequency to be created (and recorded) while making a recording. For this reason, it is imperative that all of these elements be thoroughly degaussed and cleaned for the purpose of this procedure, as well as at all other times.

8-85 Symmetry control R15, on the audio bias and erase oscillator card (see Figure 8-3) is factory-set to cause the minimum second harmonic of a reproduced 500 Hz or 1 kHz signal. Minimum noise remains fairly constant through a relatively wide range of R15 settings, but the second harmonic minimum is characteristically within a very much narrower range. The ideal circumstance is one in which the R15 setting for minimum second harmonic is approximately at the center of the minimum noise range. If there is no one setting of R15 that results in minimum noise and minimum second harmonic, it is an indication that residual magnetism is present somewhere along the tape path.

8-86 By the use of a wave analyzer, R15 may be set very precisely for the minimum second harmonic of the reproduced aduio; if one is not available, the setting of R15 for noise minimum will be less precise but quite acceptable. In any event, R15 should never be adjusted to reduce noise at the expense of increasing the second harmonic content:

a. If an audio voltmeter will be used for the measurements (see step e), short pins 2 and 3 of J6S LINE IN, and connect the voltmeter input to pins 2 and 3 of J1P LINE OUT. Connect a 600 ohm resistor and a 0.1 UF capacitor in parallel across the voltmeter input. If a wave analyzer will be used, (see step f), set up the connections of Figure 8-7. Set the audio oscillator frequency at 500 Hz, and its output level at +8 dBm (1.95 Vrms).

b. Place the oscilloscope probe in TP2 of the audio bias and erase oscillator card (see Figure 8-3). Set the sweep rate at 1 Usec/division.

c. Initiate the record mode. Determine that the oscillator frequency is 100 kHz. If it is not, adjust R17 (frequency) on the audio bias and erase oscillator card. Make note of the initial symmetry of the waveform. Press the STOP pushbutton.

d. Thread a blank tape on the tape Initiate the record mode and note the tape timer reading. Make a series of 5-sec recordings while altering the setting of R15 (symmetry/noise balance) to move the crossover point of the symmetrical waveform in 10 degree increments of asymmetry, beginning with shortening the time of the positive excursion in a series of 5 increments. After 5 sec, adjust R15 to restore the initial symmetry, and repeat the procedure while shortening the time of the negative excursion. Use the cue channel to record microphone announcements of each changed setting of R15.

e. If an audio voltmeter is used, determine the setting of R15 that results in the lowest meter indication while reproducing the recording made in step c. Adjust R15 to this setting.

NOTE

The relatively broad range of the noise minimum that will be observed, is caused, in part, by the presence of 60 and 120 Hz hum which is constant. However, the total indication within the noise minimum range should be at least 30 dB down. If the playback is also monitored through the audio speaker, it will be observed that the lowest voltmeter indication coincides with the least low-frequency rumble in the audible signal.

f. If a wave analyzer is used, closely monitor its indications while reproducing the recording made in step c. The least second harmonic content may be observed at the time R15 was being turned through one of the increments; turn R15 to place the crossover point as it was at the start of this increment. Make a new recording while altering the setting of R15 in 1 degree increments, with accompanying microphone announcements of each changed setting. Reproduce this recording, determine the setting that resulted in the least second harmonic content, and set R15 accordingly.

8-87 Cue Channel Record Noise Balance. The extensive procedure used for the audio channel is not necessary for the cue channel:

a. Place the oscilloscope probe in TP2 of the cue bias and erase oscillator card (see Figure 8-3). Set the sweep rate to 1 Usec/division.

b. Initiate the record mode. Adjust R15 on the cue bias and erase oscillator card for 50-50 symmetry of the 100 kHz waveform.

8-88 Audio and Cue Head Adjustments. The individual heads within the audio and cue head assembly are adjustable, and can be repositioned to increase the effective life of the heads. If the performance of the audio and cue system is degraded by insufficient head-to-tape contact, the record/playback heads should be moved to restore the original head protrusion.

8-89 The initial effect of insufficient contact is a loss of bias, shown as variations in playback level and an excessive number of dropouts. Head repositioning is indicated whenever light pressure on the back of the tape (at the audio head) corrects an audio playback problem.

8-90 The following tools are required to complete this procedure:

a. Allen-head wrench set, including 3/64 in., 5/64 in., 7/64 in., and 9/64 in. (Ampex 1221545).

b. Right-angle Phillips-head screwdriver, #1 size.

c. Phillips-head screwdriver, #1 size.

d. Allen-head wrench, 5/32 in., short end cut to 7/16 in. (Ampex 55585). (ITEM 31)

e. Allen-head wrench, 3/32 in. (ITEM 32)

f. Step alignment gauge, 3 mil (Ampex 52534). (ITEM 30)

8-91 The audio head assembly must be completely disassembled to perform this procedure; refer to Figure 8-11 throughout. The item numbers referred to are shown in the figure (note that these item numbers are for the purposes of this procedure only, and are not the same as the LM item numbers in Section 10):

a. Remove audio and cue head assembly (1) from the recorder by removing four cap head screws (2) with an appropriately-sized Allen-head wrench.

b. Remove decorative overlay (3) and shields (4) and (5) by removing two flathead screws (6) with a 5/64 in. Allen-head wrench.

c. Remove shield (9) and hinge base (7) by removing two screws (8) with the #1 Phillips-head screwdriver. Cap (10) and spring (11) will also be removed;do not lose these parts.

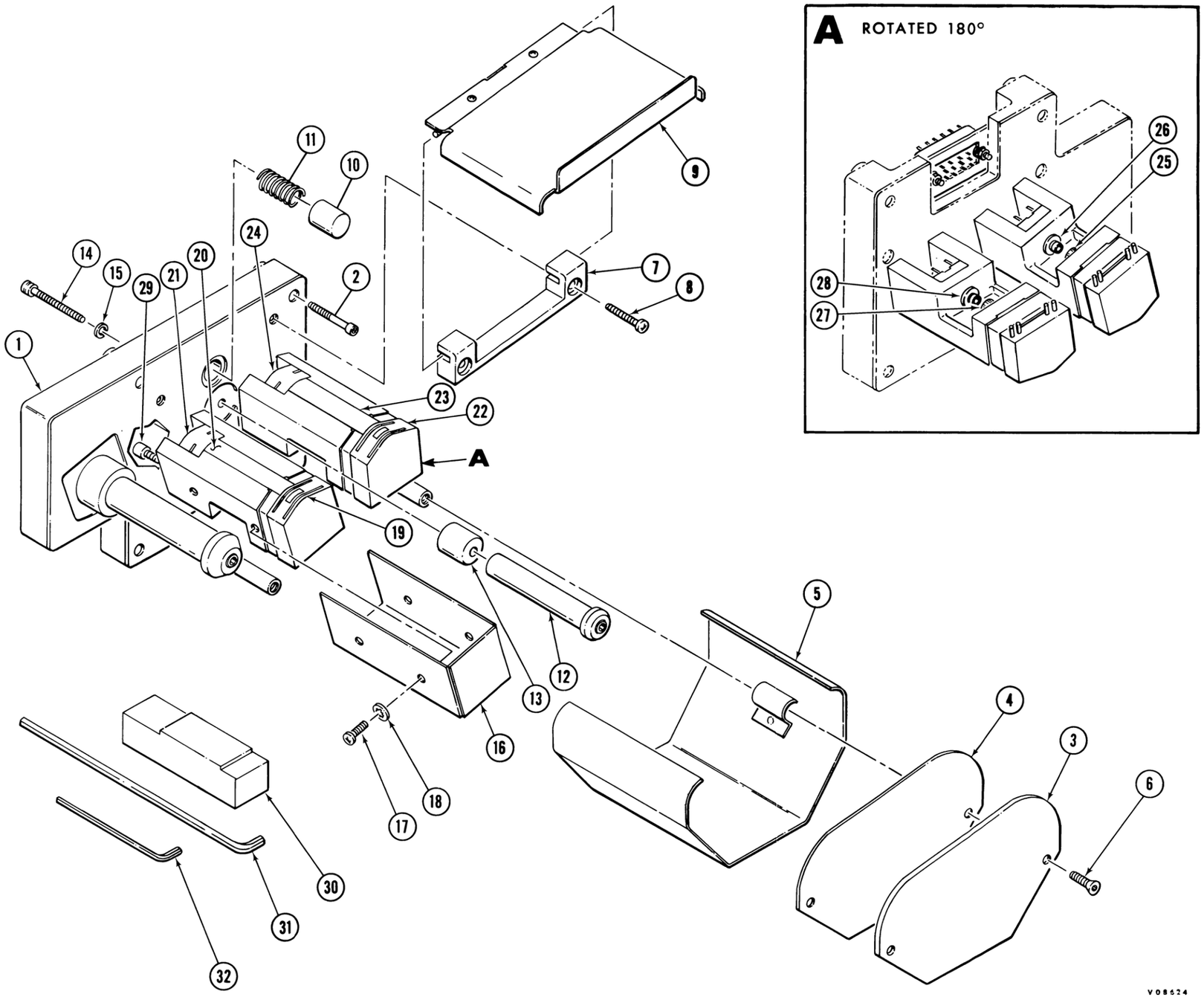


Figure 8-11. Audio and Cue Head Assembly Exploded View

d. Remove tape guide (12) and guide base (13) by removing mounting screw (14) from the rear of the head assembly. Use a 7/64 in. Allen-head wrench; save lockwasher (15).

e. Remove shield (16) from the record/playback head assembly by removing four screws (17) and lockwashers (18). Use the right-angle Phillips-head screwdriver to avoid scratching the erase head assembly.

f. Free the audio record/playback head (19) by loosening mounting screw (25) (DETAIL A) with item d of paragraph 8-90 (31).

g. Free the cue record/playback head (21) by loosening mounting screw (26) (DETAIL A) with item e of paragraph 8-90 (32).

h. Place the step alignment gauge (30), item f of paragraph 8-90, on the record/playback head plate (20). The SHORT end of the gauge should face head (19).

i. Hold gauge (30) against plate (20), and push head (19) out until it stops. At this point it will project 3 mils into the tape path, which is the proper projection.

j. Maintaining this projection, tighten mounting screw (25) with wrench (31).

k. Hold gauge (30) against plate (20), and push head (21) out until it stops. At this point it also will project 3 mils into the tape path.

l. Maintaining this projection, tighten mounting screw (26) with wrench (32).

m. Free the audio erase head (22) by loosening mounting screw (27) (DETAIL A) with wrench (32).

n. Free the cue erase head (24) by loosening mounting screw (28) (DETAIL A) with wrench (32).

o. Place the step alignment gauge (30) on the erase head plate (23). The SHORT end of the gauge should face head (22).

p. Hold gauge (30) against plate (23), and push head (22) out until it stops.

q. Maintaining this projection, tighten mounting screw (27) with wrench (31).

r. Hold gauge (30) against plate (23), and push head (24) out until it stops.

s. Maintaining this projection, tighten mounting screw (28) with wrench (32).

t. Apply a light coating of thinned Dykem (or an equivalent mechanics' dye) to the tape-contacting surface of heads (19), (21), (22), and (24).

u. Without re-assembling the audio and cue head assembly (1), mount it on the tape transport using the original mounting screws (2).

v. Thread a roll of tape on the tape transport, and run the recorder in the fast forward mode for about one minute.

w. Stop the transport, and remove the head assembly from it. Closely examine the surface of the heads; the dye should have been removed equally from both sides of each head gap. If the dye on one side of the gap has been removed more than the dye on the other side (indicative of uneven wear), perform step x for each head so affected.

x. Loosen the head mounting screw and tilt the head in the direction of greater wear; retain the 3 mil projection set in the preceding steps. Repeat steps u through w until the wear on each head is even, and the projection is 3 mils.

y. Clean the heads with head cleaner (Ampex 087-007) to remove the remaining dye.

z. Re-assemble audio and cue head assembly (1) by performing steps a through e in reverse order. If guide (13) has a groove worn in it, rotate it to expose a new surface to the tape edge.

aa. Lay one edge of a plastic triangle or other suitable straightedge across the plane formed by erase head guide (23), the tape guide post (12), and record/playback head guide (20). The straightedge must contact only two of these three surfaces. If it contacts all three surfaces, perform step ab.

ab. Loosen guide post mounting screw (14) and move the post down. Repeat step aa. If necessary, loosen the mounting screws (29) of a head assembly, and move it down.

ac. Replace the audio and cue head assembly.

8-92 System Control Unit Adjustments. The timers in the system control unit have been factory set, and should not require adjustment unless a defective component is replaced. The adjustments may be made with a stopwatch and a 24 volt indicator of some sort, but more accurate adjustment may be made with an oscilloscope capable of accurate time measurements at low sweep speeds (Tektronix 540-series or 564 storage oscilloscope, or equivalent). The following procedure describe the adjustments using an oscilloscope:

a. Remove the rear panel of the recorder and the cover of the system control unit. Turn on the system power.

b. Place the oscilloscope probe in TP1 of the sequence timer board; set the sweep speed to 0.2 sec/division, and the vertical sensitivity to 10V/division.

c. Set the oscilloscope sweep to run free, and adjust the horizontal position control so that the sweep begins exactly on the left-hand graticule line. If the oscilloscope used is not capable of storage, turn the beam intensity up to a high level (high enough to persist, but not high enough to damage the phosphor).

d. Set the oscilloscope triggering for a positive, internal 24V trigger.

e. Load and thread a roll of tape on the transport.

f. Press the PLAY pushbutton. The sweep should begin, traverse exactly 5 graticule divisions, change voltage level, and continue until the end of the sweep; if the triggering controls are properly set, it will not begin again. Press the STOP pushbutton.

g. Repeat step f to determine that the time measurement was correct; if the period of the pulse is not 1.0 sec, perform step h.

h. Adjust R1 on the sequence timer board, then repeat step g.

i. Move the oscilloscope probe to TP2, and set the sweep rate at 0.5 sec/division. Set the oscilloscope triggering for a positive, external 24V trigger; connect the trigger input to TP1.

j. Press the PLAY pushbutton.

k. The sweep should begin, traverse exactly 2 graticule divisions, change voltage level, continue for exactly 1 graticule division, change voltage level again, and continue to the end of the sweep. Press the STOP pushbutton.

l. Repeat step j to determine that the time measurement was correct; if the period of the pulse is not 0.5 sec, perform ste m.

m. Adjust R3 on the sequence timer board, then repeat step l.

n. Move the oscilloscope to TP3.

o. Press the PLAY pushbutton.

p. The sweep should begin, traverse exactly 3 graticule divisions, change voltage level, continue for exactly 4.6 graticule divisions, change voltage level again, and continue to the end of the sweep.

q. Press the STOP pushbutton.

r. Repeat step p to determine that the time measurement was correct; if the period of the pulse is not 2.3 sec, perform step s.

s. Adjust R5 on the sequence timer board, then repeat step r.

t. Move the oscilloscope probe to TP4 and the trigger probe to TP3.

u. Set the sweep rate at 0.1 sec/division; set the oscilloscope triggering for a negative, external 24V trigger.

v. Press the PLAY pushbutton.

w. The sweep should begin, traverse exactly 2 graticule divisions, change voltage level, and continue to the end of the sweep. Press the STOP pushbutton.

x. Repeat step v to determine that the time measurement was correct; if the period of the pulse is not 0.2 sec, perform step y.

y. Adjust R7 on the sequence timer board, then repeat step v.

z. Observe the tape transport operation to determine that the timing is smooth and normal.

8-93 Air and Vacuum System Adjustments

8-94 Bearing Air System Pressure Adjustments. If a change is normal operating pressure of the bearing air system is noticed, or if the familiarization and checkout procedure in Section III shows the pressure to be out of tolerance, the regulator and switches may need adjustment. If the BEARING AIR warning indicator lights with normal bearing air pressure, only the switches need adjustment. This procedure should be performed after the compressor has been overhauled:

a. If possible, test the air bearing compressor with Ampex pressure test kit 800-787 before proceeding; overhaul the compressor if necessary. Remove the rear panel of the recorder.

b. Connect the compressor air and power lines to the recorder; turn the system power on.

NOTE

Some of the following steps require the use of an assistant, as bearing air pressure is read at the rear of the recorder.

c. Check the bearing air pressure after one minute; it should be 55 (±2) psi. If it is not, perform step d.

d. Adjust the air pressure regulator on the bearing air compressor until the pressure gage reads 55 (±2) psi.

e. Momentarily increase the pressure above 55 (±2) psi. The BEARING AIR warning indicator should light. If it does not, perform step f.

f. Adjust the 50-55 psi switch adjustment screw of the air bearing pressure switch assembly so that the warning indicator lights above 55 psi. See Figure 4-6 and Figure 8-12.

g. Momentarily decrease the pressure below 50 (±2) psi. The BEARING AIR warning indicator should light. If it does not, perform step h.

h. Adjust the 50-55 psi switch adjustment screw of the air bearing pressure switch assembly so that the warning indicator lights below 50 psi. See Figure 4-6 and Figure 8-12.

i. Re-adjust the air pressure regulator on the bearing air compressor until the pressure gage reads 55 (±2) psi.

j. Press the READY pushbutton; the head drum will rotate.

CAUTION

IF THE BEARING AIR PRESSURE IS ALLOWED TO DECREASE TOO FAR BELOW 40 PSI WITH HEAD DRUM POWER STILL APPLIED, THE HEAD WILL BE SEVERLY DAMAGED.

k. Pull out AIR COMPRESSOR circuit breaker CB12 (on the system power supply front panel). At exactly 40 psi, the head drum power should be disconnected, and the head drum rotation will begin to cease. If this action does not take place at 40 psi, perform step l.

l. Adjust the 40 psi switch adjustment (see Figure 8-12), then repeat step k.

8-95 Vacuum System Adjustments. If a change in normal operating vacuum is noticed, or if the familiarization and checkout procedure in Section III shows the vacuum to be out of tolerance, the vacuum relief valve and switches may need adjustment. If the GUIDE VACUUM warning indicator and/or the REC LOCK OUT warning indicator light with normal

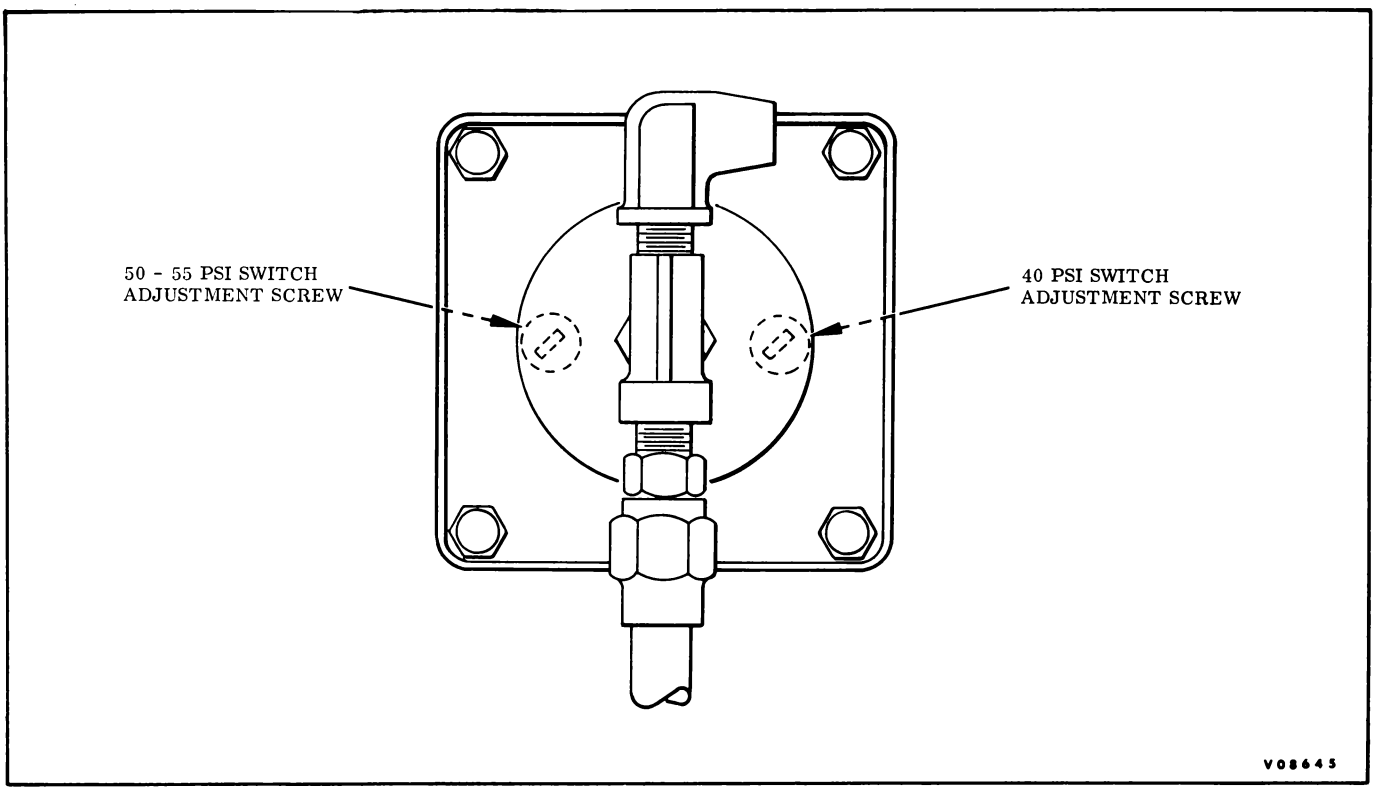


Figure 8-12. Bearing Air Pressure Switch Adjustment

vacuum, only the switches need adjustment; this procedure should also be performed after the vacuum pump has been overhauled:

NOTE

Some of the following steps require the use of an assistant, as guide vacuum is read at the rear of the recorder.

a. If it has not already been done, remove the rear panel of the recorder.

b. Turn on the system power.

c. Load and thread a reel of tape onto the tape transport.

d. Check the guide vacuum; it should be 40 (±2) in. H2O. If it is not, perform step e.

e. Remove the cover jar from the vacuum relief valve (see Figure 4-7). Adjust the vacuum relief valve until the gage reads 40 (±2) in. Replace the jar and check the vacuum again; it will change. Once the differential has been established, adjust the vacuum relief valve again so that the vacuum will be 40 (±2) in. with the jar on.

f. Momentarily cover the vacuum regulator air intake (see Figure 4-7); the vacuum gage reading will rise. Above 50 in., the GUIDE VACUUM warning indicator should light. If it does not, perform step g.

g. Adjust the high vacuum switch adjustment screw (see Figure 4-7), then repeat step f.

h. Momentarily lift the tape out of the video head vacuum tape guide; the vacuum gage reading will decrease. At 30 (±2) in., the GUIDE VACUUM and REC LOCK OUT warning indicators should light. If they do not, perform step i.

i. Adjust the low vacuum switch adjustment screw (see Figure 4-7), then repeat step h.

j. Repeat step d.

k. Replace the recorder rear cover.

8-96 Replacement and Modification Procedures

8-97 INCREASING POWER SUPPLY CURRENT CAPACITY. When accessories (signal system accessories, Electronic Editor, Mark II Editec, etc.) are added to the VR-1200B in the field, the current demands on the positive and negative 12 volt supply in the system power supply are increased. In order to meet these demands, and maintain the output regulation within specified tolerances, the following procedure must be performed.

8-98 Instructions contained in accessory manuals pertaining to power supply modification are superseded by this procedure.

a. Remove the + and -12V power supply module from the system power supply (see Figure 7-1).

WARNING

IN THE FOLLOWING STEPS, THE USER MAY BE EXPOSED TO POTENTIALLY LETHAL LINE VOLTAGE. ALWAYS TURN OFF THE SYSTEM POWER BEFORE DOING ANY SOLDERING, AND OBSERVE NORMAL PRECAUTIONS FOR HIGH-VOLTAGE EQUIPMENT.

b. Connect the power supply to its mating connector in the system power supply through extender cable 1360953, supplied with the recorder.

c. Turn on the system power and check the line voltage; if it is below 112 Vrms, perform step d.

d. Turn off system power. Move the power transformer tap from the 115V terminal (terminal A4) to the 105V terminal (terminal A2).

e. Break the lines indicated by an "X" in Figure 8-13, and place a dc ammeter (preferably a variable-range ammeter) in series with each shunt regulator.

f. Find the mode of recorder operation which requires the greatest current

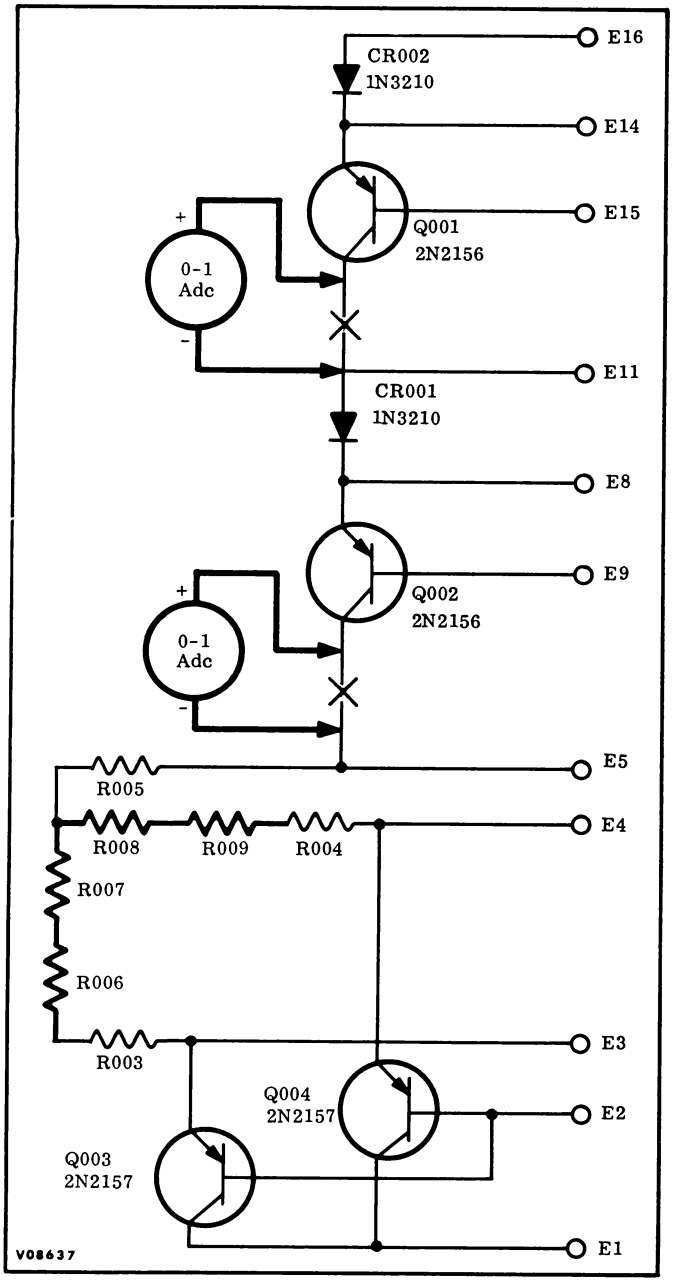


Figure 8-13. Shunt Regulator Current Measurement

(i.e., least current through the shunt regulators). This will probably be in the playback or record mode, with the Electronic Editor on, and the SERVO MODE selector set to AUTO, while the Intersync servo is in the process of locking.

g. Under these maximum-current conditions, the current through the shunt regulators should be approximately 250 mA. If the current through either shunt regulator is less then 250 mA, perform step h.

h. Put jumpers across resistor R007 and resistor R008.

i. Repeat steps f and g. If the current through either shunt regulator is still less than 250 mA, place jumpers across resistor R006 and resistor R009.

j. Repeat steps f and g.

k. Stop the tape transport. The current through the shunt regulators will increase, but should not be more than 1A.

NOTE

The current through the two shunt regulators will probably not be of equal value.

l. Restore the VR-1200B to its normal operating condition.

m. Using a dc voltmeter with and accuracy of ±0.1% or better, adjust the positive and negative 12V power supplies to 12 ±0.25V (and within 0.1V of each other). A relatively inexpensive digital voltmeter such as the Hickock DMS 3200 will be satisfactory for this purpose.

8-99 REPLACEMENT OF COMPLIANCE ARM DAMPING FLUID. Should it become necessary to replace the silicone damping fluid in the transport compliance arm(s), perform the following procedure:

a. Locate the Nylok setscrew in the compliance arm assembly, and remove them.

b. Fill the cavity with silicone damping fluid (Ampex 087-074) through one of the holes until the fluid is visible in the other hole.

c. Replace the setscrews.

8-100 CAPSTAN BELT REPLACEMENT AND ADJUSTMENT. The following procedure details the method for replacing the capstan belt and adjusting the tension. If the belt is not replaced, and it is desired that the tension alone be adjusted, ignore steps i and k.

8-101 The following tools are required to perform this procedure:

a. Allen wrench set (Ampex 1221545)

b. Cap screw, Allen head, #10-32 (ITEM 20)

c. Torque wrench capable of measuring 2-3 in. lbs. (typically 5-0-5 in. lbs.). (ITEM 22)

d. Torque wrench adapter - torque wrench to Allen wrench (ITEM 21)

e. Large straight-slot screwdriver (ITEM 23)

8-102 The following procedure is keyed to Figure 8-14. The item numbers referred to are shown in the figure (these item numbers are for the purpose of this procedure only, and are not the same as the LM item numbers in Section 10):

a. Turn off the system power, and disconnect the power cable of the recorder.

b. Remove the rear panel of the recorder.

c. Remove the wiring and the fanning strip from terminal block (1) on the capstan motor assembly (2).

d. To protect the capstan shaft (19) from damage, wrap it completely with masking tape or a suitable substitute. With the same material, lock the shaft to the housing so it will not move.

e. Remove capstan motor assembly (2) from the tape transport (3) by removing cap screw (4) - four places - with an appropriately-sized Allen wrench.

f. Move the capstan motor assembly to a workbench, and remove plate (5)

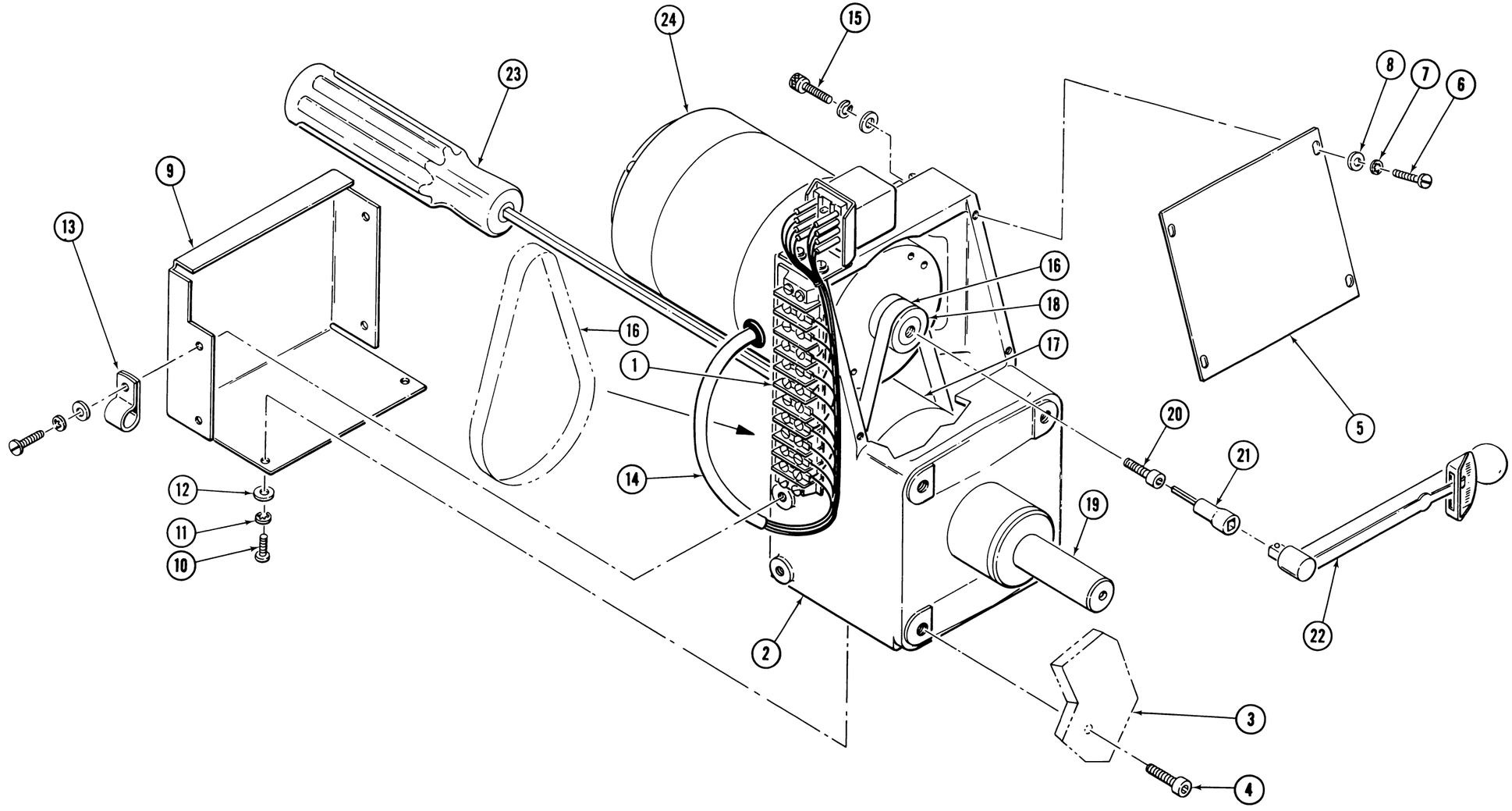


Figure 8-14. Capstan Motor Assembly Exploded View

by removing screw (6), lockwasher (7), and flat washer (8) four places.

g. Remove plate (9) by removing screw (10), lockwasher (11), and flat washer (12) six places. In addition, remove cable clamp (13) from wire harness (14).

h. Loosen motor mounting screw (15) - four places - and allow the motor to slip down.

i. If belt (16) is to be replaced, remove the old belt at this time.

WARNING

METHYL ALCOHOL IS EXTREMELY FLAMMABLE IN BOTH LIQUID AND VAPOR FORM.

j. Thoroughly clean motor shaft (18) and pulley (17) with methyl alcohol.

CAUTION

DO NOT FORCE THE BELT ON, OR ROTATE THE CAPSTAN SHAFT TO DRIVE IT ON. IF THE BELT IS CREASED, IT WILL BE USELESS.

k. Slip the new belt (16) over pulley (17) and motor shaft (18).

l. Move capstan motor (2) up to tighten the belt, then finger tighten mounting screw (15) four places.

m. Replace plate (9) and mounting hardware (10), (11), and (12) and cable clamp (13).

n. Thread cap screw (20) (item b of paragraph 8-101) into the hole in motor shaft (18). Attach torque wrench adapter (21) (item d of paragraph 8-101) and torque wrench (22) (item c of paragraph 8-101) as shown.

o. Insert a screwdriver (23) or other suitable prying tool into the space between capstan motor (24) and cover (9).

NOTE

The capstan shaft must be prevented from rotating to perform the following check.

p. Find the motor position which satisfies the following conditions:

1. The belt MUST NOT slip below 2 in. lbs. of torque

2. The belt MUST slip above 3 in. lbs. of torque

q. Tighten motor mounting screws (15) four places, then repeat the torque check. It may be necessary to reposition the motor.

r. Re-assemble the capstan motor assembly, and mount it to the tape transport top plate. Re-connect the wiring in the recorder to terminal block (1).

s. Remove the tape or other protective material from the capstan shaft.

NOTE

The capstan shaft must be entirely free of residue. Kerosene will remove masking tape residue, and alcohol will remove kerosene residue. Alcohol by itself however, will not remove masking tape residue.

8-103 Trouble Isolation

8-104 GENERAL. A malfunction of any unit in the VR-1200B recorder may be isolated and its cause identified using normal troubleshooting techniques, and referring to the appropriate block diagrams, schematic diagrams, and waveforms.

8-105 In the event of a system malfunction, first check the fuses and circuit breakers associated with the units in question (locations are shown in Figures 2-1, 2-2, and 7-1). Fuses for the processing amplifier and Amtec and Colortec accessories are located at the lower left on the front panel of each unit. With the exception of the audio and cue chassis fuses, all fuseholders illuminate when the fuse is open.

8-106 POWER SUPPLIES. After checking the fuses, the voltages at the power supply test

points should be measured to determine that they are present and within tolerance (refer to paragraph 7-8); a precision voltmeter (±0.1% or better) should be used. A relatively inexpensive digital voltmeter (Hickock DMS 3200 or equivalent) is satisfactory for this purpose.

8-107 The test points for the system power supply are shown in Figure 7-1; the test points for the audio and cue system power supplies are located on the rear panel of the audio and cue chassis.

8-108 A power supply malfunction may be isolated and its cause be determined using normal troubleshooting techniques, and referring to the appropriate block diagrams in Section VII and the schematic diagrams in Section IX. After repair, the power supply voltages must be set to the levels and tolerances delineated in paragraph 7-8 of Section VII.

8-109 A power supply module in the system power supply may be serviced by removing it from the power supply chassis and connecting it through the appropriate extender cable (1360952 or 1360953, supplied with the recorder) to the mating connector on the power supply chassis.

8-110 The audio and cue system power supply modules may be removed from the audio and cue chassis by removing the single screw that holds the module to the chassis and pulling the module straight back.

8-111 WAVEFORMS. The waveforms which follow this section of the manual (Figures 8-16 through 8-34) have been included as an aid to trouble isolation; the waveforms shown are photographs of signals as they appeared on an oscilloscope screen. (The oscilloscope used was a Tektronix 543 with a type L preamplifier. This type of oscilloscope was selected as being representative of oscilloscopes commonly found at broadcast television stations; to keep circuit loading at a minimum, a 10:1 probe was used.)

8-112 The location of the test point, the vertical sensitivity, and the triggering point of the oscilloscope are shown for each waveform. The vertical sensitivity is the overall vertical sensitivity, not necessarily the setting of the preamplifier; therefore, if a vertical sensitivity of 1V/division is shown for a waveform, and a 10:1 probe is used, the oscilloscope amplifier must be set to 0.1V/division.

8-113 Unless otherwise indicated in the paragraphs which follow, the recorder power must be on and the recorder in the e-e mode when these waveforms are observed.

NOTE

With the exception of the video signal system waveforms, all waveforms shown in this section are available at test points accessible from the outside of the unit under test.

8-114 Table 8-5 gives the locations of the waveforms in this section.

8-115 Mark Ten Head Assembly. The Mark Ten Head Assembly is fully described in manual 1809956. The waveforms in Figure 8-16 of this manual show the signals at test points TP1 and TP3 when the VR-1200B is in the ready, play, or record mode. Failure to obtain these waveforms is probably indicative of a malfunction of the Intersync servo system rather than the head assembly itself.

8-116 The head preamplifier module of the head assembly is described in Section V of this manual; the schematic diagram is in Section IX. The LM is in Section X.

8-117 Audio and Cue System. The locations of the audio and cue system test points are shown in Figure 8-3. For service, or more comprehensive waveform analysis than these procedures require, extender card 53519 (supplied with the processing amplifier) may be used between the audio and cue chassis and the audio and cue cards.

8-118 The input signal for the waveforms in Figure 8-17 was a 500 hertz, +8 dBm sine wave from a source impedance of 600 ohms; the VR-1200B was in the record mode.

8-119 The audio and cue system is described in Section VI; the schematic diagrams are in Section IX. The LM's are in Section X.

8-120 Video Erase Driver. The video erase driver chassis is located inside the VR-1200B console, behind the erase head assembly. The video erase driver fuseholder (illuminated) may be reached from the rear of the recorder.

Table 8-5 Waveform Location

UNIT	FIGURE	PAGE
Mark Ten Head Assembly	8-16	8-46
Audio and Cue System	8-17	8-47
Video Erase Driver	8-18	8-48
System Control Unit	8-19	8-49
Processing Amplifier	8-20	8-50, 8-51
Video Signal System		
Modulator (Module 2)	8-21	8-52, 8-53
Record Amplifier (Module 5)	8-22	8-54, 8-55
Channel Amplifier (Module 6)	8-23	8-56
RF Switcher and Equalizer (Module 7)	8-24	8-57 to 8-61
Switcher Logic (Module 8)	8-25	8-62 to 8-68
Demodulator (Module 9)	8-26	8-69 to 8-71
Output Video (Module 11)	8-27	8-72 to 8-76
Sync Processing (Module 12)	8-28	8-77 to 8-82
Dropout Sensor and Gate (Module 13)	8-29	8-83
Intersync Servo System	8-30	8-84 to 8-86
Amtec Accessory	8-31	8-87
Colortec Accessory	8-32	8-88
Waveform Monitor	8-33	8-89/90
Video Monitor	8-34	8-91/92

8-121 In order to obtain access to the chassis test points, the right-hand side panel (as viewed from the rear) must be removed; the side panel is held in place by two captive wing-screws, which are loosened from the inside of the console. When these screws are loose, the side panel may be lifted up and off the track which holds it to the console.

8-122 Figure 8-15 shows the location of the test points on the video erase driver chassis; the signals at TP2 and TP3 are shown in Figure 8-18. TP1 carries positive 24 volts when the erase driver is activated.

8-123 The video erase driver is described in Section V; the schematic diagram is in Section IX. The LM's are in Section X.

8-124 System Control Unit. The system control unit test points may be reached by removing the rear panel of the recorder and the system control unit cover.

8-125 System control unit waveforms are shown in Figure 8-19. The beginning of the sweep is coincident with the time the PLAY pushbutton is pressed (i.e., coincident with the time power is applied to the 1.0 second timer); the 24 volt pulse begins when power is applied to a timer, and ends when the timer activates.

8-126 The system control unit is described in Section VII; the schematic diagram is in Section IX and the list of materials are in Section X.

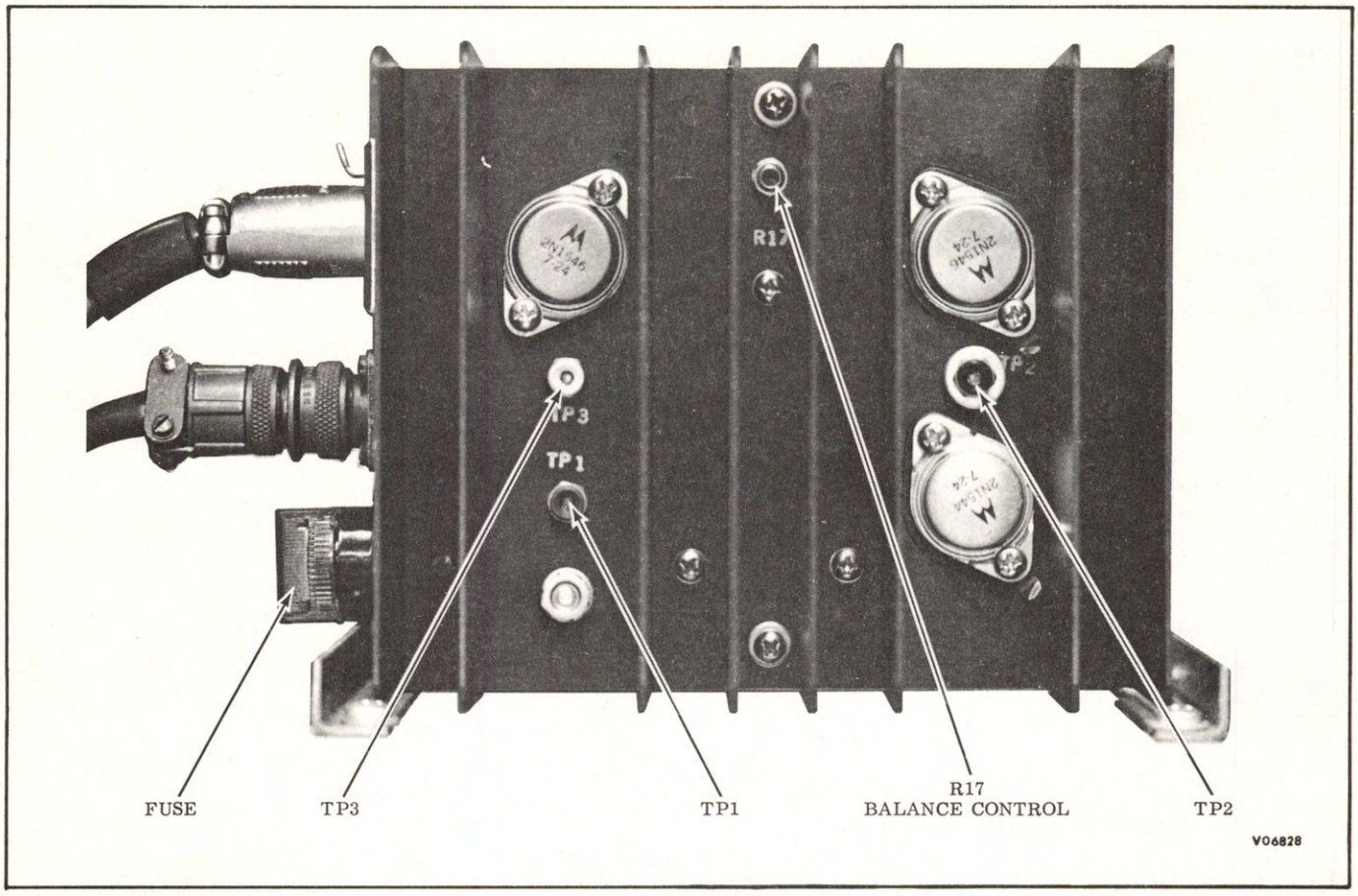


Figure 8-15. Video Erase Head Driver Test and Adjust Points

8-127 Processing Amplifier. The processing amplifier is fully described in manual 1809989. The waveforms in Figure 8-20 are photographs of signals appearing at the test points directly above the processing amplifier control panel. This panel may be reached by pulling the track-mounted processing amplifier straight out from the VR-1200B console.

8-128 For these waveforms, the recorder was in the e-e mode; the signal system and the processing amplifier were set to 525-line standard positions. The input signal was a 525-line color bar test signal, 1V p-p. Sync for oscilloscope triggering is available at TP2 of Intersync module 1.

8-129 Video Signal System. The signal system waveforms shown in Figures 8-21 through 8-29 were taken with the module under test mounted on extender board 1211977 supplied with the recorder. The input signal was a 525-line multiburst (monochrome) test signal, 1V p-p with the exception of module 13, which was checked with a standard 525-line color bar signal.

8-130 The location of the test point for a particular waveform is its location on the schematic diagram of the module, not necessarily the physical location on the printed wiring board. The schematic diagram should be in conjunction with the assembly drawing of the module to locate the most accessible test point for any waveform.

8-131 No waveforms are supplied for signal system accessories or for the low-pass filter (module 10); waveforms for the signal system accessories are found in the separate manual for each accessory. The low-pass filter may be checked by determining that the input from the demodulator and the output to the output video module are correct.

8-132 The video signal system is described in Section V, schematic diagrams are in Section IX, and lists of materials are in Section X.

8-133 Intersync Servo System. The Intersync servo system is fully described in manual 1809927. The waveforms in Figure 8-30 are photographs of signals appearing at test points on the front panel. These will only complement the more complete coverage in the Intersync manual.

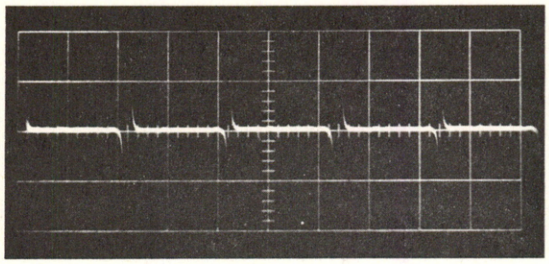
8-134 Most waveforms can be observed while the recorder is in the e-e mode; to observe tachometer signals, however, the head drum must be rotating. The VR-1200B must be in the record mode to check control record current, and in the playback mode to check the control track playback.

8-135 Amtec Accessory. The Amtec accessory is fully described in manual 1809923. The waveforms in Figure 8-31 are photographs of signals appearing at the test points directly behind the Amtec control panel. This panel may be reached by pulling the track-mounted Amtec accessory straight out from the VR-1200B console.

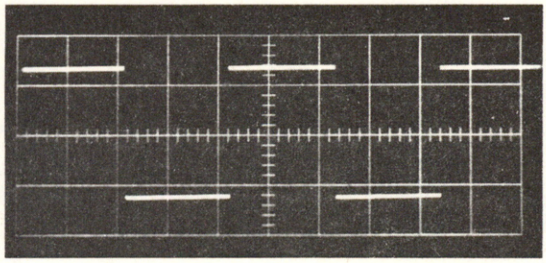
8-136 The input signal was a 525-line color bar test signal, 1V p-p.

8-137 Colortec Accessory. The Colortec accessory is fully described in manual P59560. The waveforms in Figure 8-32 are photographs of signals appearing at the test points directly behind the Colortec control panel. This panel may be reached by pulling the track-mounted Colortec accessory straight out from the VR-1200B console. The input signal was a 525-line color bar test signal, 1V p-p.

8-138 Waveform and Video Monitors. Figures 8-33 and 8-34 show typical waveforms and video monitor displays for each position of the VIDEO MONITOR and WAVEFORM MONITOR selectors. These figures should be used as guides to determine proper operation of the monitor console; individual waveforms may vary as the input from the recorder changes.



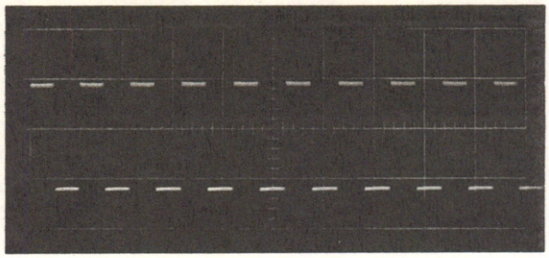
TP1
Sensitivity: 2V/Division
Sweep Rate: 1 msec/Division
Trigger: Internal



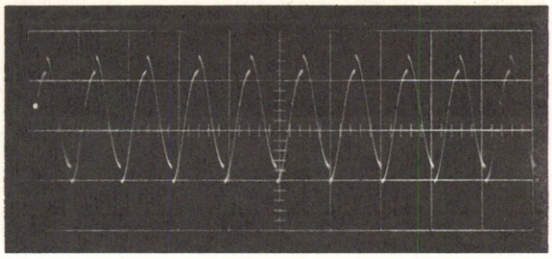
TP3
Sensitivity: 2V/Division
Sweep Rate: 1 msec/Division
Trigger: Internal

V06722

Figure 8-16. Mark Ten Head Assembly Waveforms

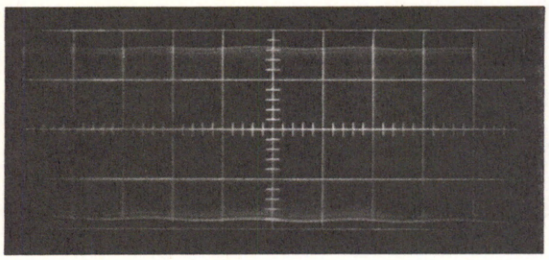


BIAS AND ERASE OSCILLATOR TP1
Sensitivity: 10V/Division
Sweep Rate: 10 μsec/Division
Trigger: Internal

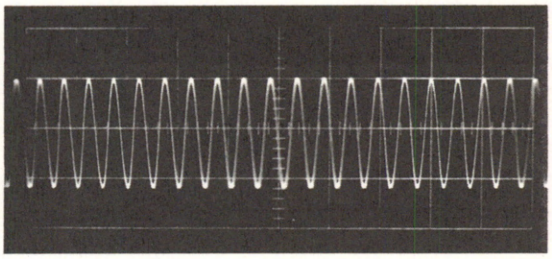


180V P-P

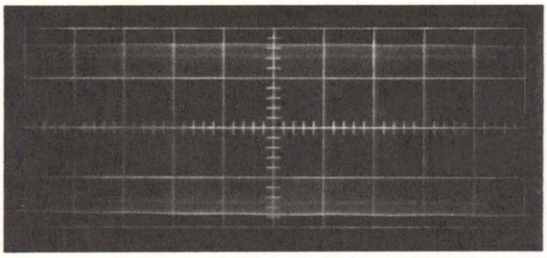
BIAS AND ERASE OSCILLATOR TP2
Sensitivity: 30V/Division
Sweep Rate: 10 μsec/Division
Trigger: Internal



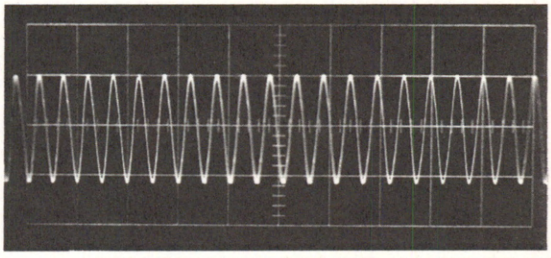
CUE CHANNEL RECORD AMPLIFIER TP1
Sensitivity: 7V/Division
Sweep Rate: 1 msec/Division
Trigger: Internal



CUE CHANNEL RECORD AMPLIFIER TP1
Sensitivity: 10V/Division
Sweep Rate: 20 μsec/Division
Trigger: Internal



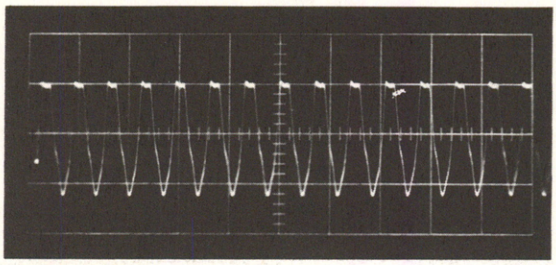
AUDIO CHANNEL RECORD AMPLIFIER TP1
Sensitivity: 7V/Division
Sweep Rate: 1 msec/Division
Trigger: Internal



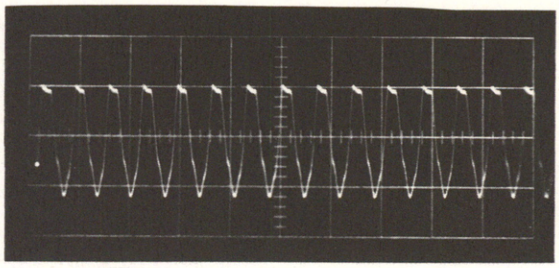
AUDIO CHANNEL RECORD AMPLIFIER TP1
Sensitivity: 10V/Division
Sweep Rate: 20 μsec/Division
Trigger: Internal

V06720

Figure 8-17. Audio and Cue Chassis Waveforms



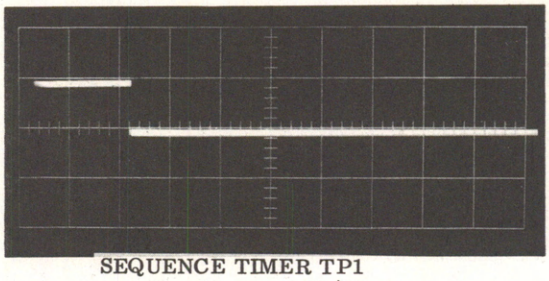
TP2
Sensitivity: 10V/Division
Sweep Rate: 20 μsec/Division
Trigger: Internal



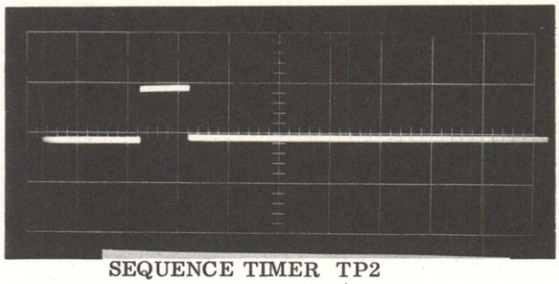
TP3
Sensitivity: 10V/Division
Sweep Rate: 20 μsec/Division
Trigger: Internal

V06721

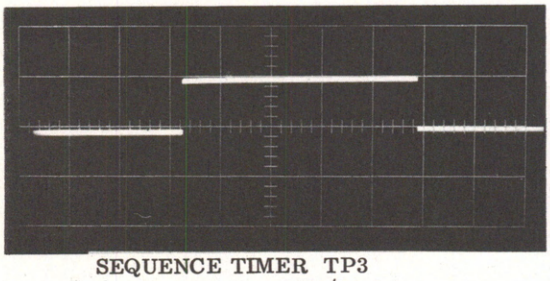
Figure 8-18. Video Erase Driver Waveforms



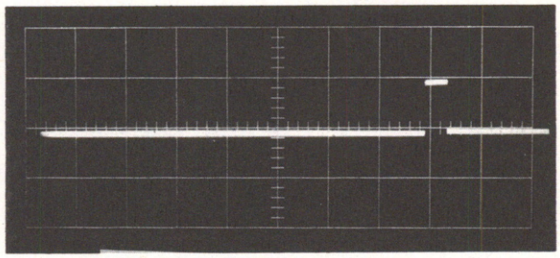
SEQUENCE TIMER TP1
Sensitivity: 20V/Division
Sweep Rate: 0.5 sec/Division
Trigger: Sequence Timer TP1



SEQUENCE TIMER TP2
Sensitivity: 20V/Division
Sweep Rate: 0.5 sec/Division
Trigger: Sequence Timer TP1



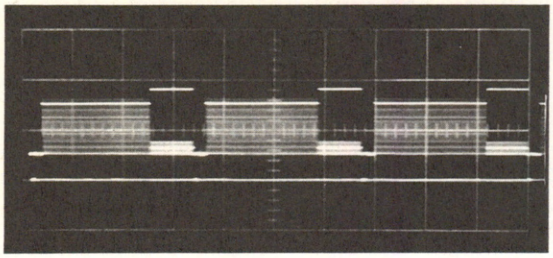
SEQUENCE TIMER TP3
Sensitivity: 20V/Division
Sweep Rate: 0.5 sec/Division
Trigger: Sequence Timer TP1



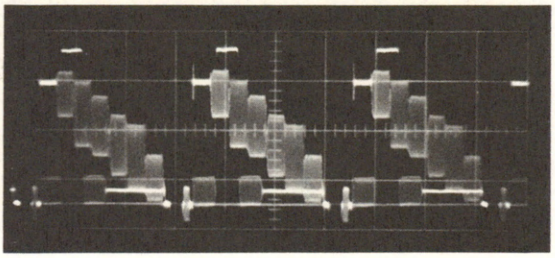
SEQUENCE TIMER TP4
Sensitivity: 20V/Division
Sweep Rate: 0.5 sec/Division
Trigger: Sequence Timer TP1

V06727

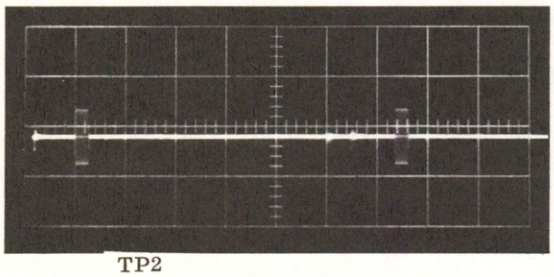
Figure 8-19. System Control Unit Waveforms



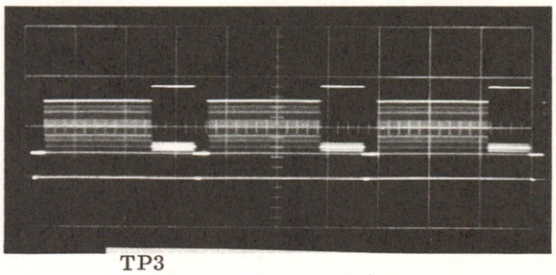
TP1
Sensitivity: 0.5V/Division
Sweep Rate: 5 msec/Division
Trigger: Sync



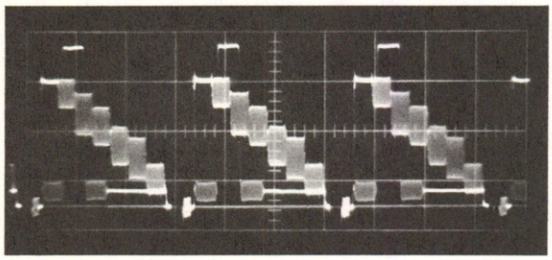
TP1
Sensitivity: 0.2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



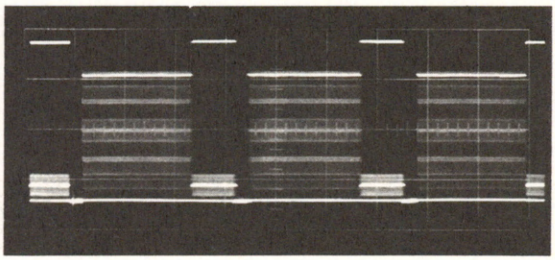
TP2
Sensitivity: 0.1V/Division
Sweep Rate: 10 μsec/Division
Trigger: Sync



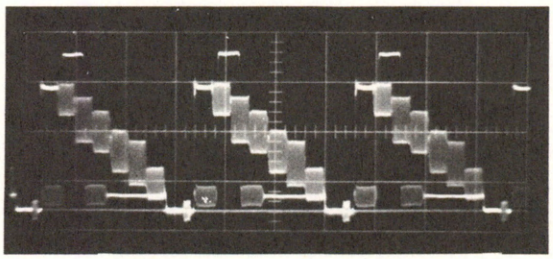
TP3
Sensitivity: 0.5V/Division
Sweep Rate: 5 msec/Division
Trigger: Sync



TP3
Sensitivity: 0.2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



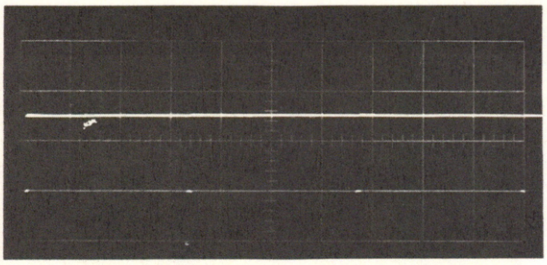
TP4
Sensitivity: 0.2V/Division
Sweep Rate: 5 msec/Division
Trigger: Internal



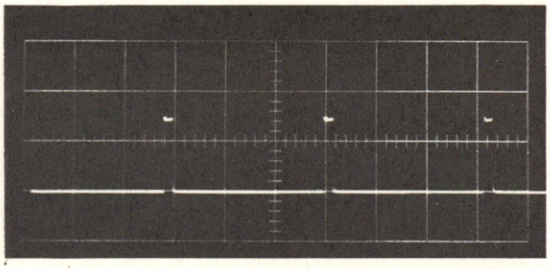
TP4
Sensitivity: 0.2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Internal

V06725

Figure 8-20. Processing Amplifier Waveforms, Sheet 1 of 2



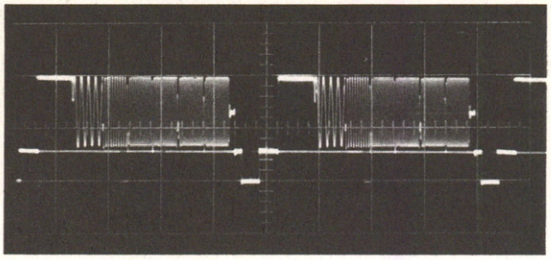
TP5
Sensitivity: 5V/Division
Sweep Rate: 5 msec/Division
Trigger: Internal



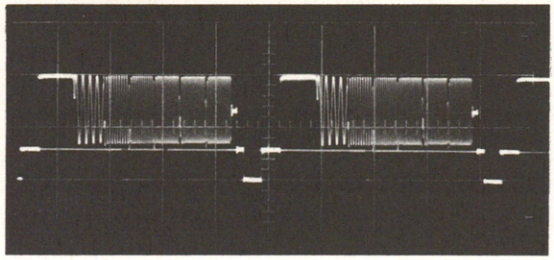
TP6
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Internal

V06726

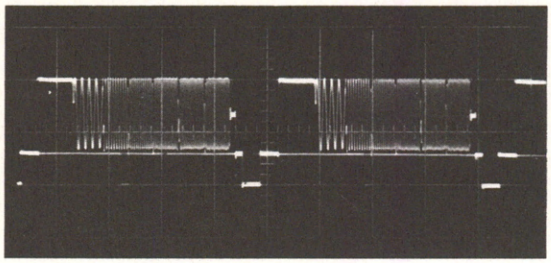
Figure 8-20. Processing Amplifier Waveforms, Sheet 2 of 2



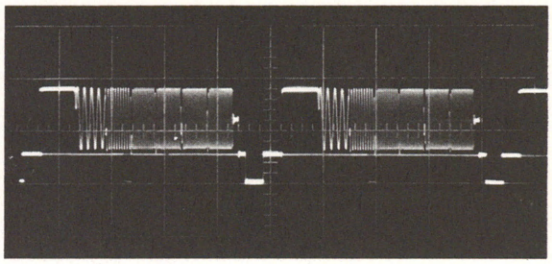
PIN 3 OF J002
Sensitivity: 0.5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



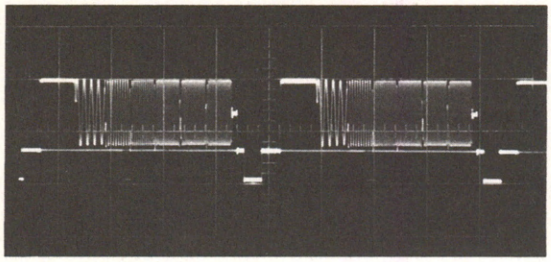
PIN 4 OF J002
Sensitivity: 2V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



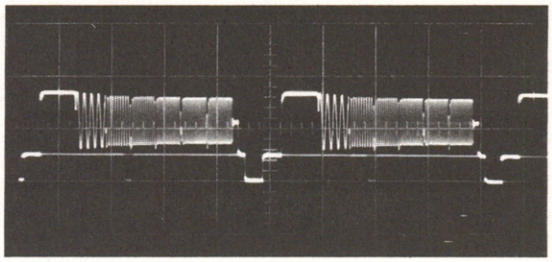
PIN 5 OF J002
Sensitivity: 0.5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



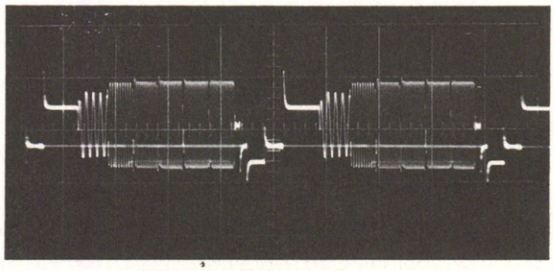
JUNCTION OF R26 AND R16
Sensitivity: 2V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



BASE OF Q1
Sensitivity: 1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



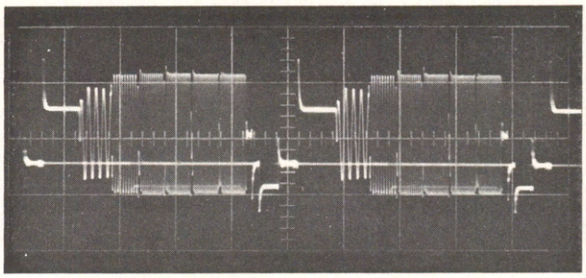
PIN 7 OF J002
Sensitivity: 1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



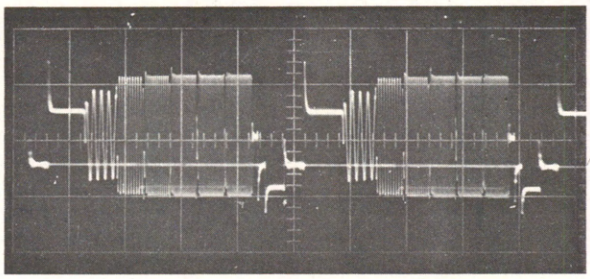
PIN 12 OF J002
Sensitivity: 0.2V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync

V06417

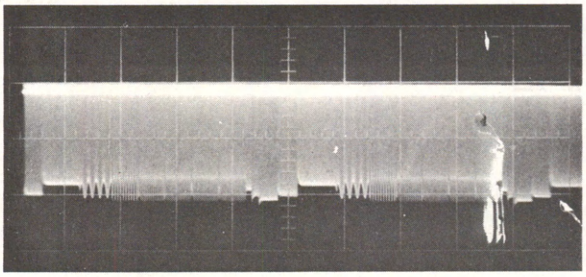
Figure 8-21. Modulator Waveforms, Sheet 1 of 2



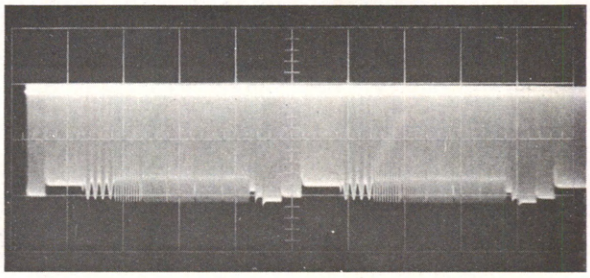
COLLECTOR OF Q9
Sensitivity: 1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



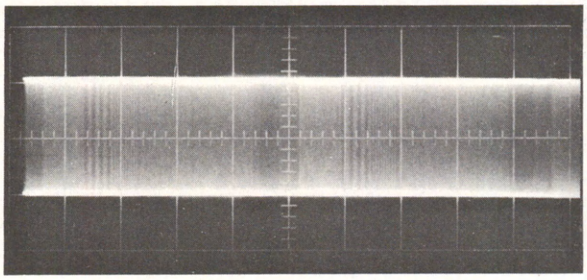
EMITTER OF Q11
Sensitivity: 1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



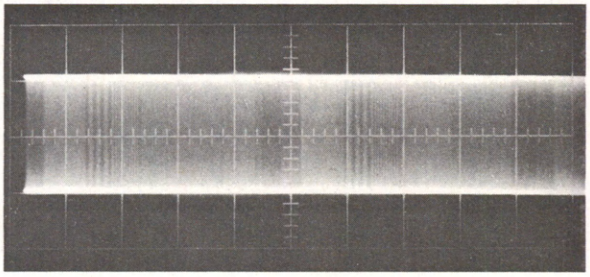
BASE OF Q14
Sensitivity: 1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



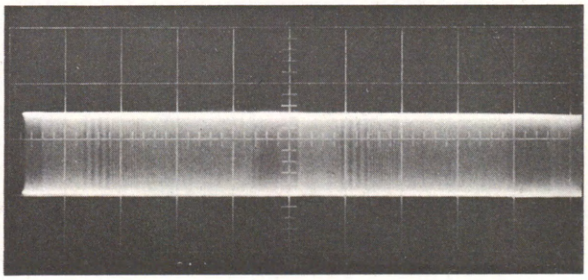
BASE OF Q15
Sensitivity: 1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



EMITTER OF Q17
Sensitivity: 2V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync

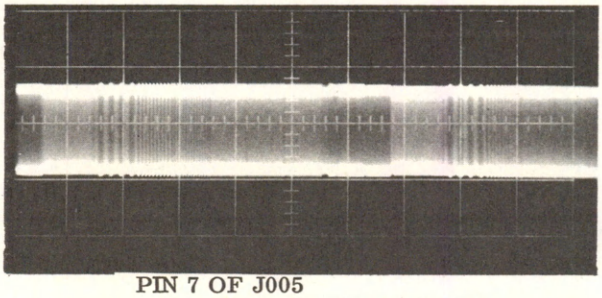


EMITTER OF Q16
Sensitivity: 2V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync

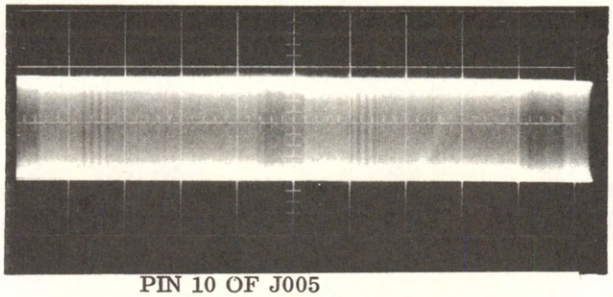


PIN 18 OF J002
Sensitivity: 0.5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync

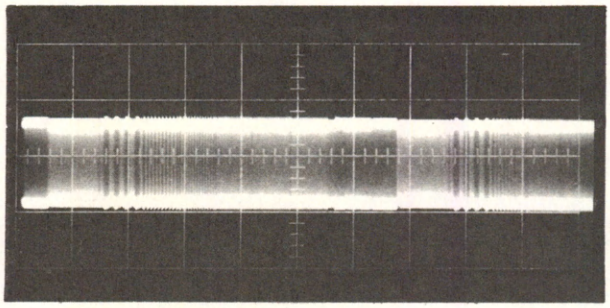
Figure 8-21. Modulator Waveforms, Sheet 2 of 2



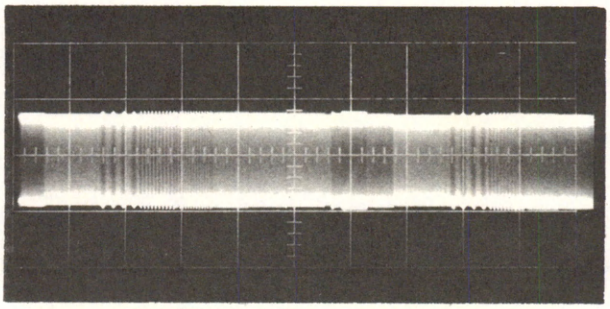
PIN 7 OF J005
Sensitivity: 0.5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



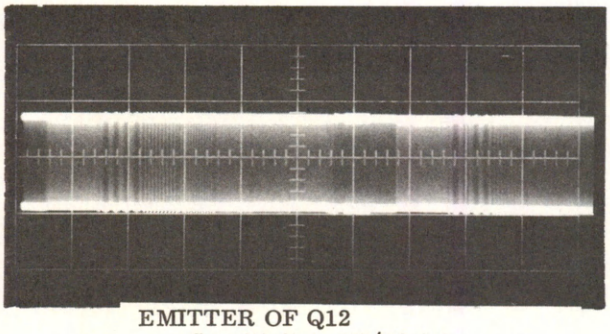
PIN 10 OF J005
Sensitivity: 0.2V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



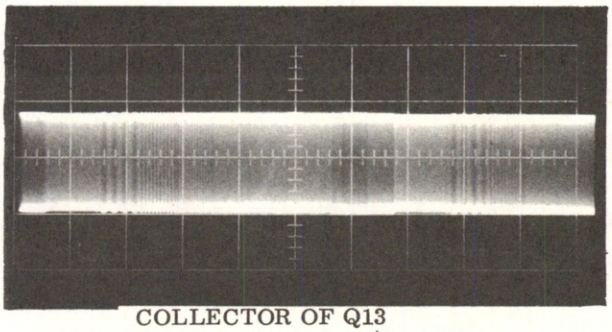
BASE OF Q11
Sensitivity: 0.5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



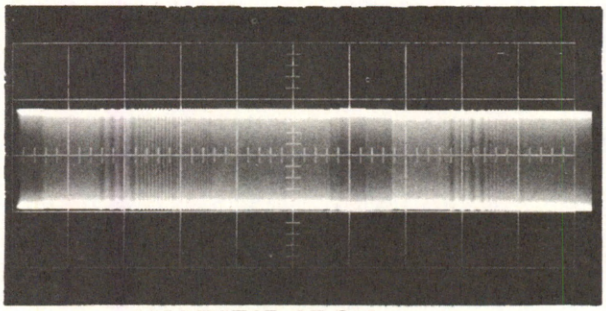
BASE OF Q12
Sensitivity: 1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



EMITTER OF Q12
Sensitivity: 1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



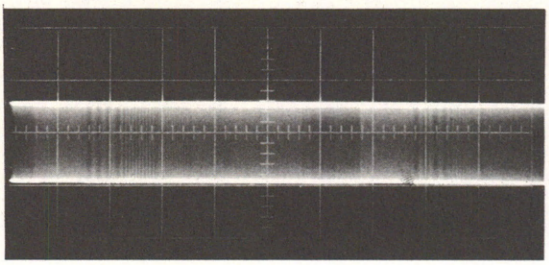
COLLECTOR OF Q13
Sensitivity: 5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



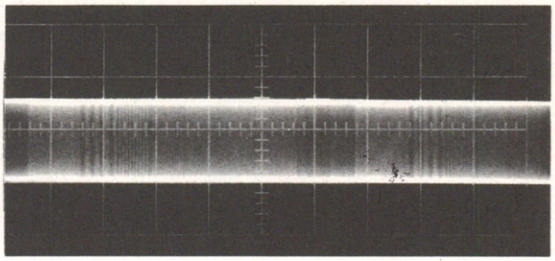
COLLECTOR OF Q15
Sensitivity: 5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync

V06419

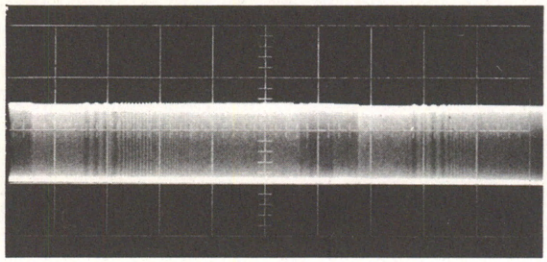
Figure 8-22. Record Amplifier Waveforms, Sheet 1 of 2



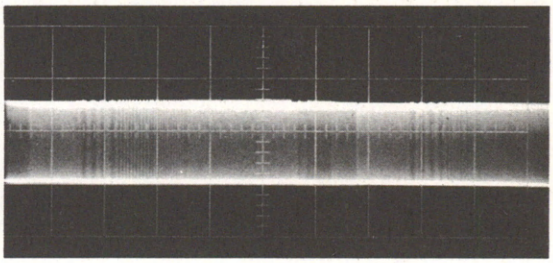
EMITTER OF Q16
Sensitivity: 5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



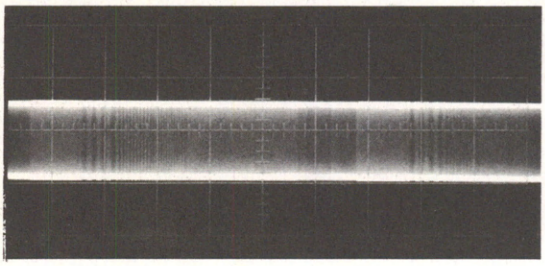
EMITTER OF Q18
Sensitivity: 5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



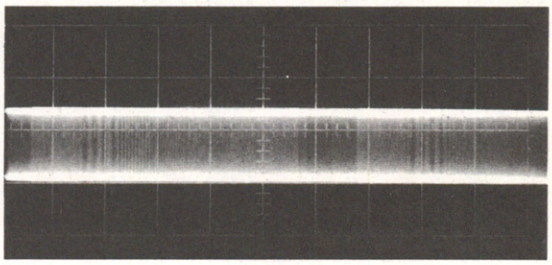
COLLECTOR OF Q1
Sensitivity: 20V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



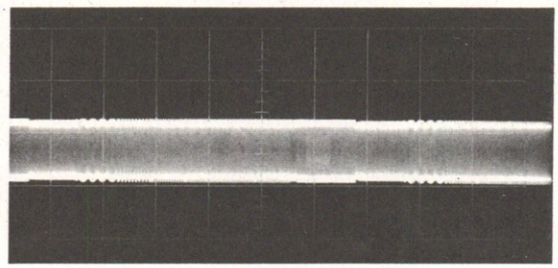
COLLECTOR OF Q2
Sensitivity: 20V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



BASE OF Q3
Sensitivity: 10V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



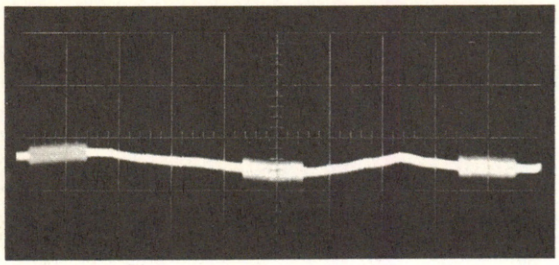
EMITTER OF Q3
Sensitivity: 10V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



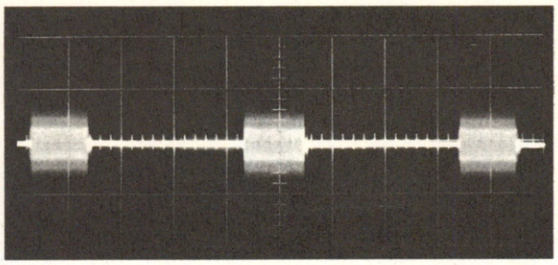
PIN A OF J005
Sensitivity: 10V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync

V06420

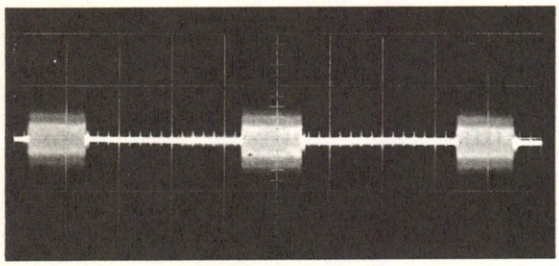
Figure 8-22. Record Amplifier Waveforms, Sheet 2 of 2



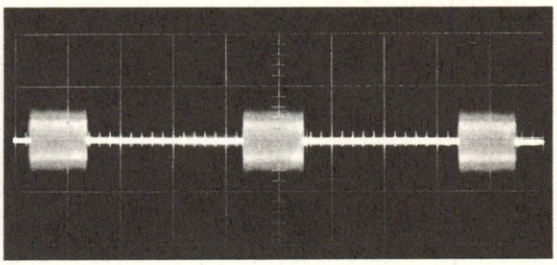
PIN 1 OF J006
Sensitivity: .01V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



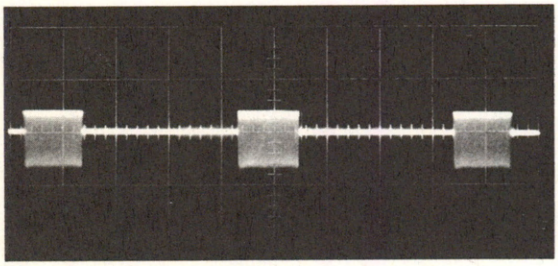
EMITTER OF Q5
Sensitivity: 0.2V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



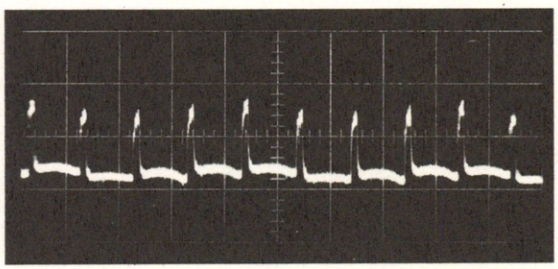
EMITTER OF Q3
Sensitivity: 0.2V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



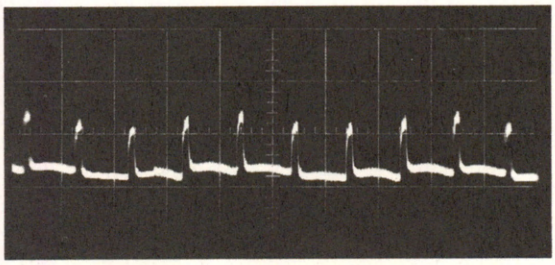
BASE OF Q2
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



COLLECTOR OF Q1
Sensitivity: 1V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



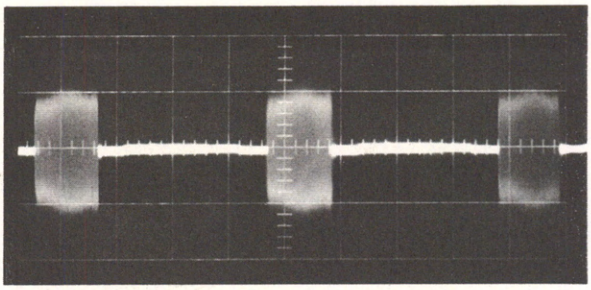
BASE OF Q25
Sensitivity: 1V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



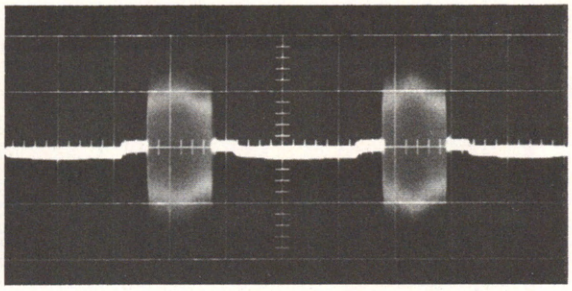
PIN 22 OF J006
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach

06425

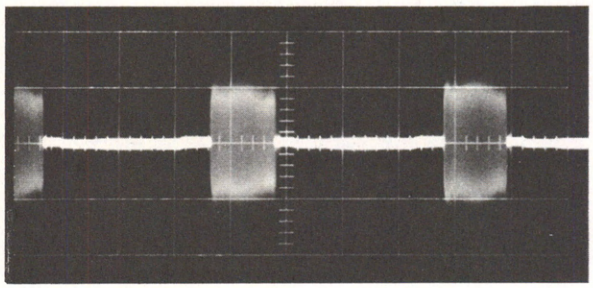
Figure 8-23. Channel Amplifier Waveforms



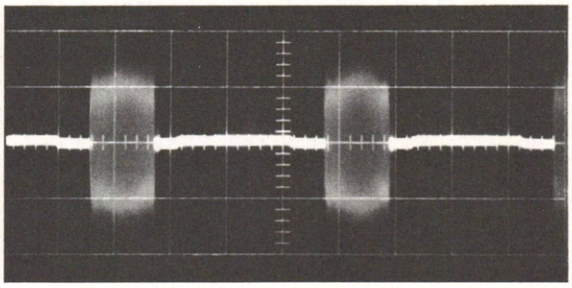
PIN 12 OF J007
Sensitivity: 0.1V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



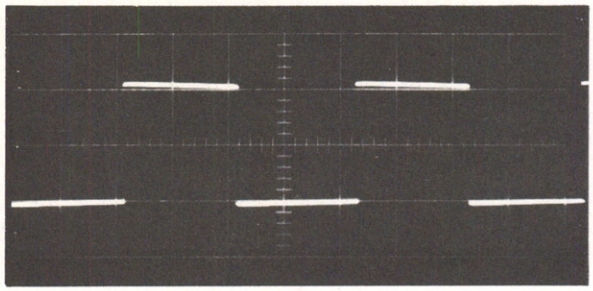
PIN 13 OF J007
Sensitivity: 0.1V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



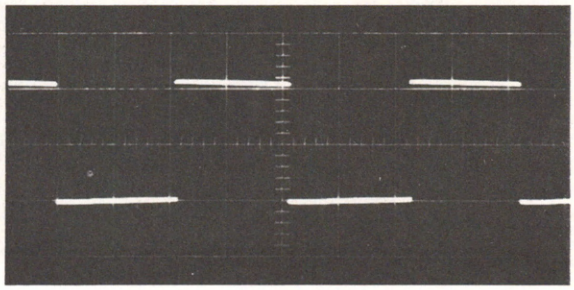
PIN 16 OF J007
Sensitivity: 0.1V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



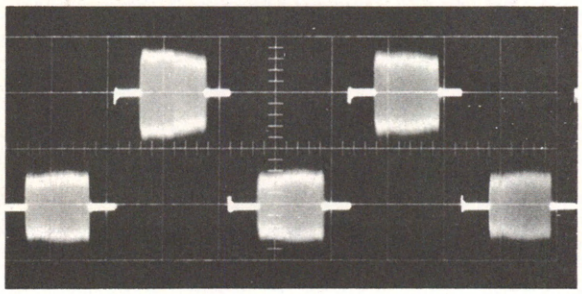
PIN 17 OF J007
Sensitivity: 0.1V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



PIN 14 OF J007
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



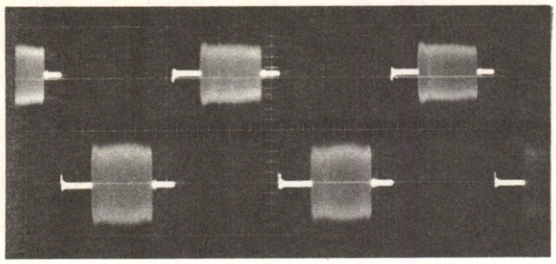
PIN 15 OF J007
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



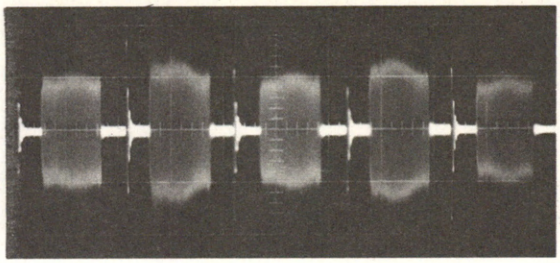
EMITTER OF Q14
Sensitivity: 0.2V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach

V06461

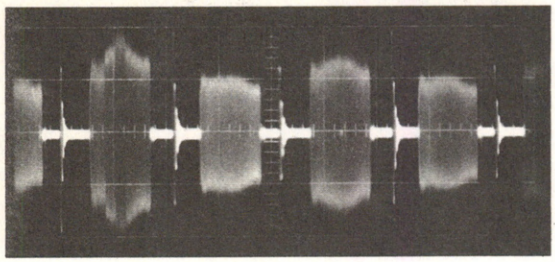
Figure 8-24. RF Switcher Waveforms, Sheet 1 of 5



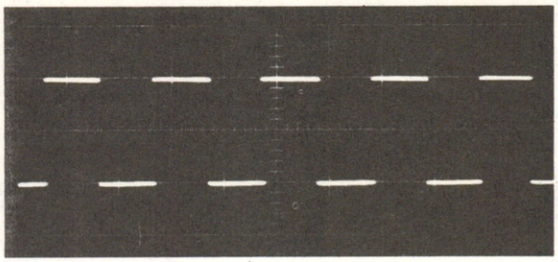
EMITTER OF Q20
Sensitivity: 0.2V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



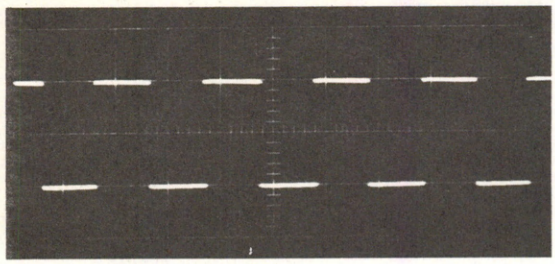
BASE OF Q13
Sensitivity: 0.1V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



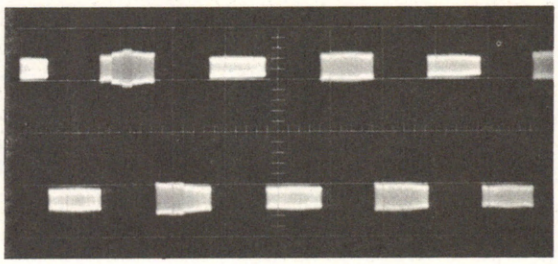
BASE OF Q18
Sensitivity: 0.1V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



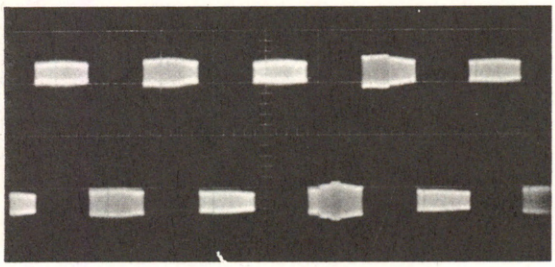
PIN 20 OF J007
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



PIN 19 OF J007
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



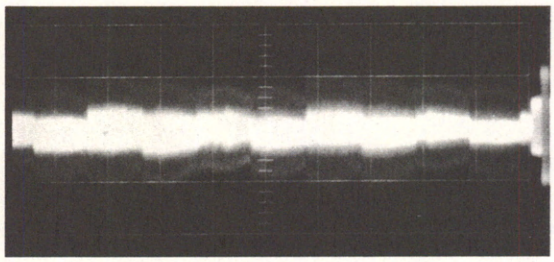
EMITTER OF Q13
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



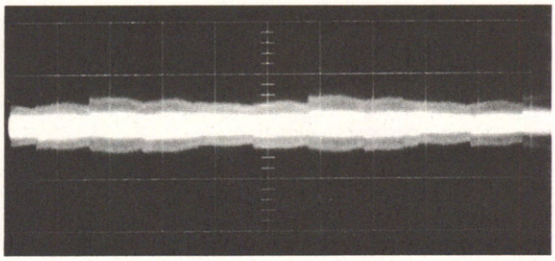
EMITTER OF Q12
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach

V06462

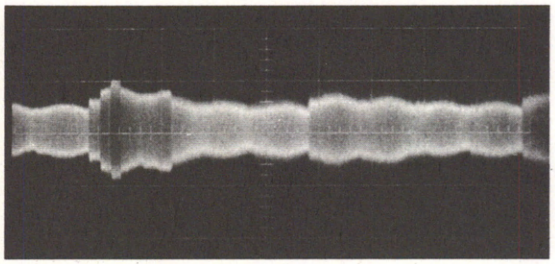
Figure 8-24. RF Switcher Waveforms, Sheet 2 of 5



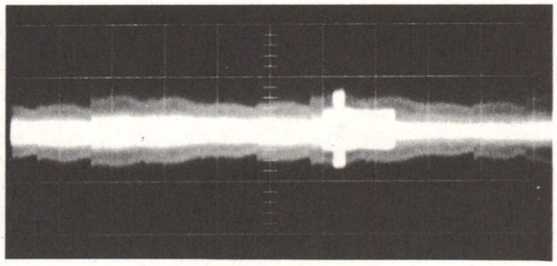
JUNCTION OF L4 AND R4
Sensitivity: 0.05V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



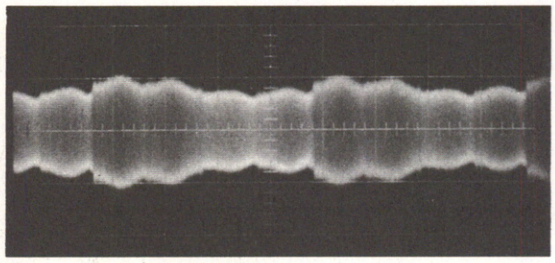
BASE OF Q10
Sensitivity: 0.05V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



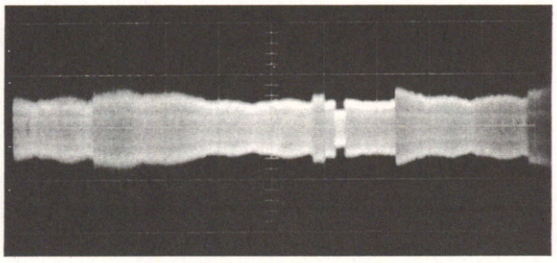
BASE OF Q11
Sensitivity: 0.2V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



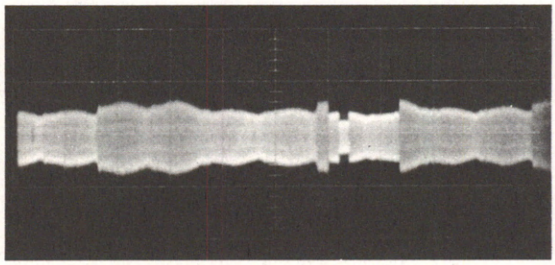
COLLECTOR OF Q10
Sensitivity: 0.05V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



BASE OF Q22
Sensitivity: 0.1V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



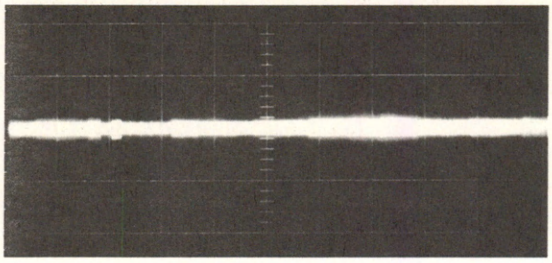
COLLECTOR OF Q22
Sensitivity: 0.05V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



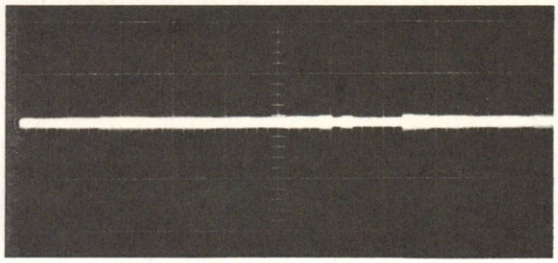
EMITTER OF Q28
Sensitivity: 0.05V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach

V06463

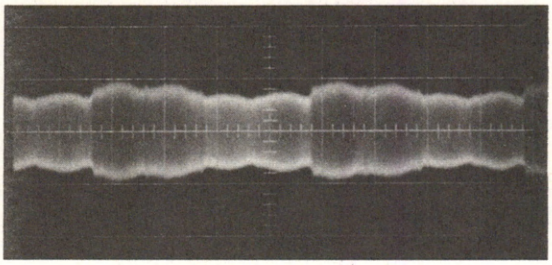
Figure 8-24. RF Switcher Waveforms, Sheet 3 of 5



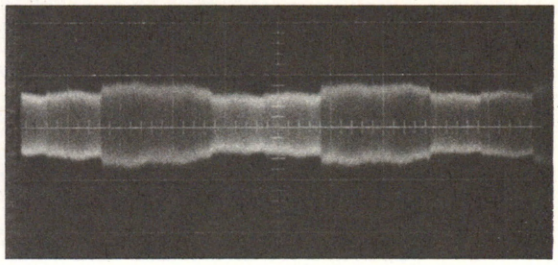
EMITTER OF Q29
Sensitivity: 0.05V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



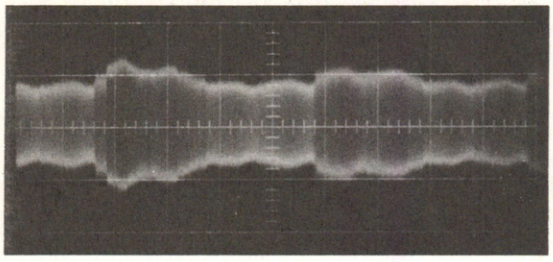
BASE OF Q30
Sensitivity: 0.05V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



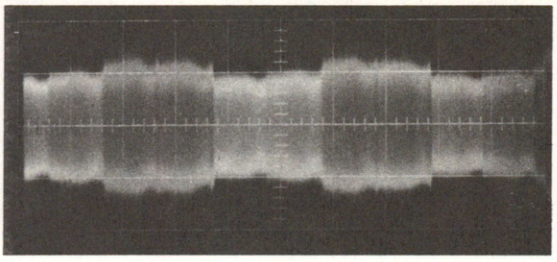
BASE OF Q31
Sensitivity: 0.05V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



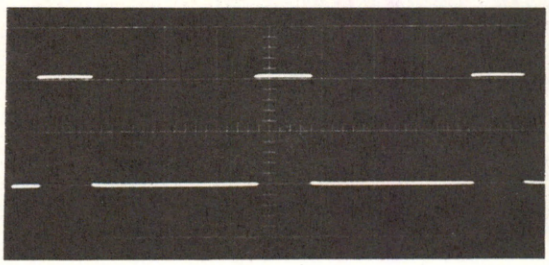
COLLECTOR OF Q31
Sensitivity: 0.1V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



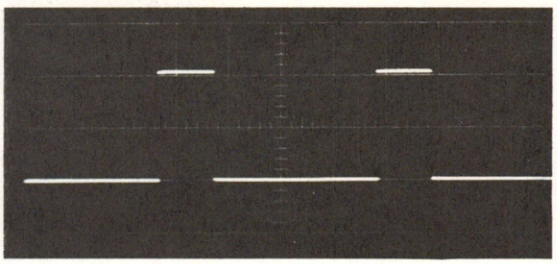
BASE OF Q27
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



PIN 22 OF J007
Sensitivity: 0.2V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



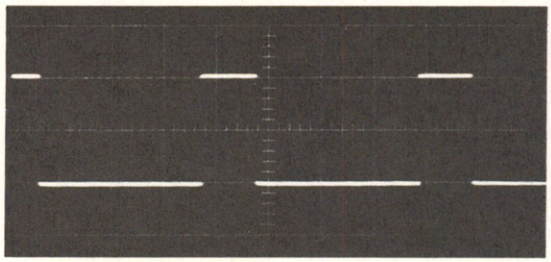
PIN 2 OF J007
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



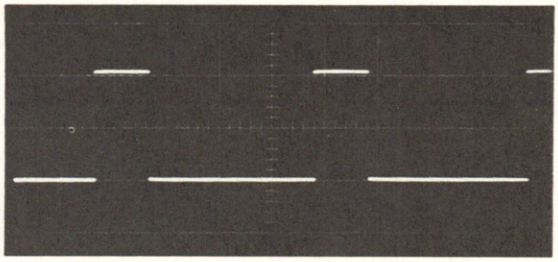
PIN 5 OF J007
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach

V06464

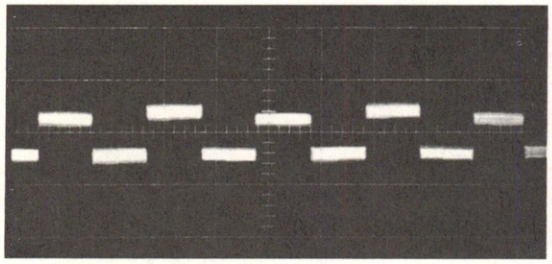
Figure 8-24. RF Switcher Waveforms, Sheet 4 of 5



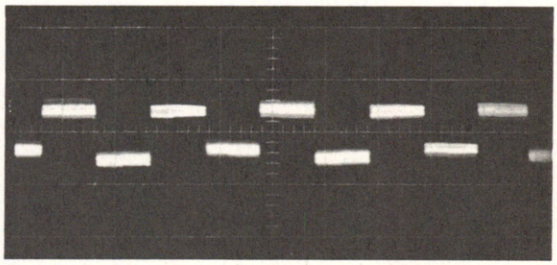
PIN 7 OF J007
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



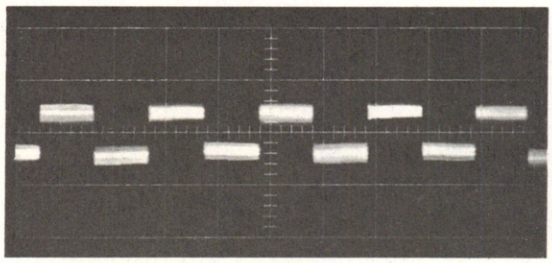
PIN 9 OF J007
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



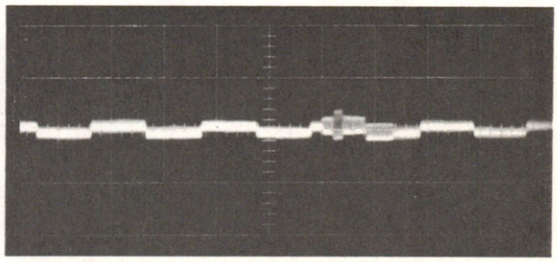
COLLECTOR OF Q3
Sensitivity: 0.05V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



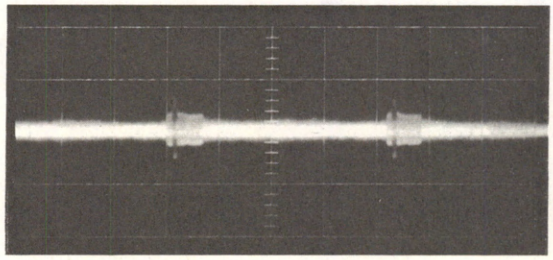
BASE OF Q24
Sensitivity: 0.05V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



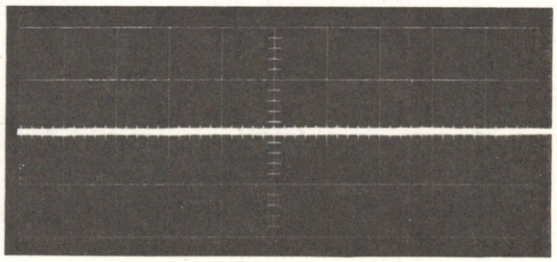
EMITTER OF Q24
Sensitivity: 0.05V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



COLLECTOR OF Q23
Sensitivity: 0.05V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



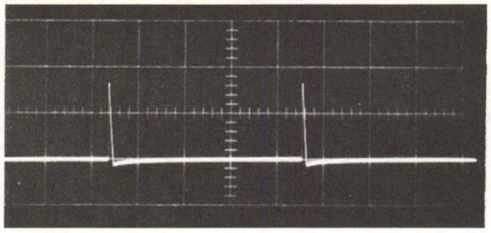
EMITTER 1 OF Q21
Sensitivity: 0.05V/Division
Sweep Rate: 2 msec/Division
Trigger: Tach



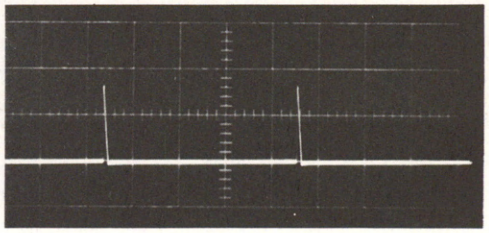
EMITTER 2 OF Q21
Sensitivity: 0.05V/Division
Sweep Rate: 2 msec/Division
Trigger: Tach

V06465

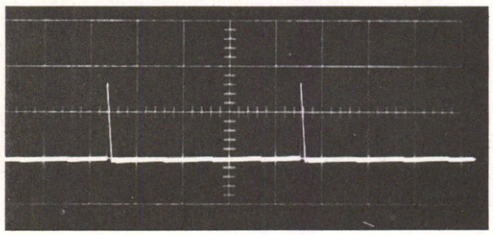
Figure 8-24. RF Switcher Waveforms, Sheet 5 of 5



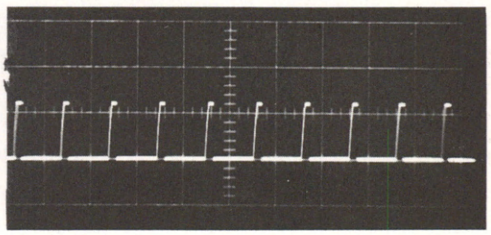
COLLECTOR OF Q2
Sensitivity: 1V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



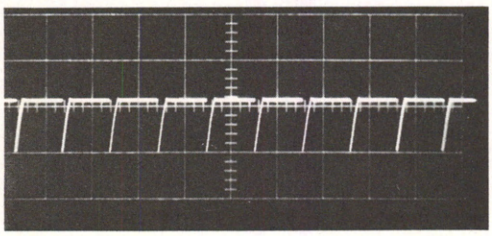
BASE OF Q1
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



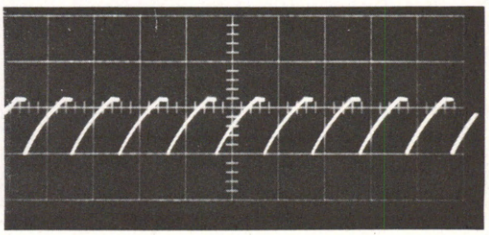
EMITTER OF Q1
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



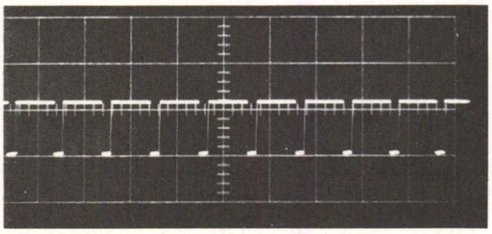
COLLECTOR OF Q26
Sensitivity: 10V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



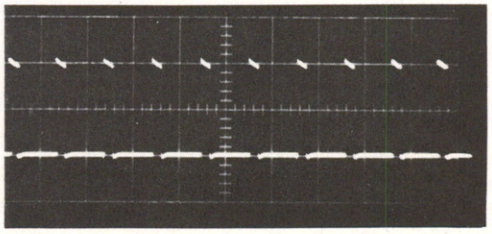
BASE OF Q26
Sensitivity: 10V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



BASE OF Q27
Sensitivity: 10V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



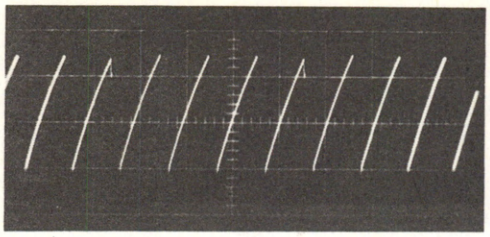
COLLECTOR OF Q27
Sensitivity: 10V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



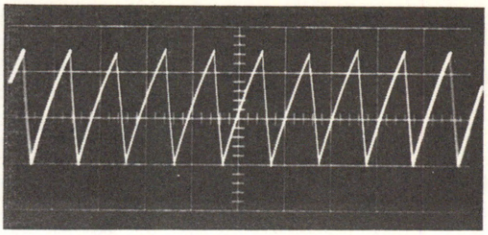
COLLECTOR OF Q28
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach

V06466

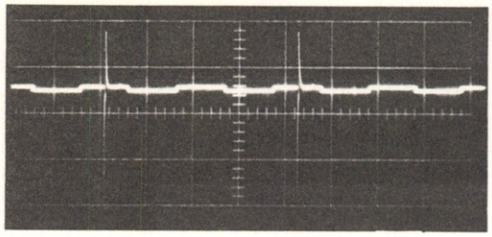
Figure 8-25. Switcher Logic Waveforms, Sheet 1 of 7



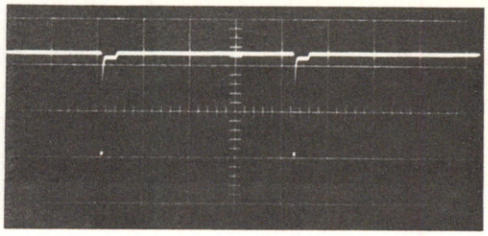
COLLECTOR OF Q29
Sensitivity: 2V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



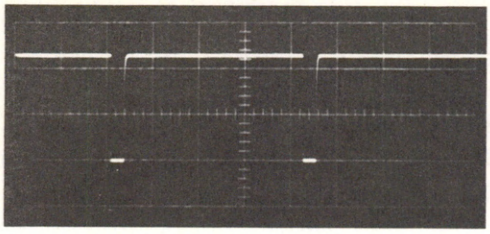
TP 3
Sensitivity: 2V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



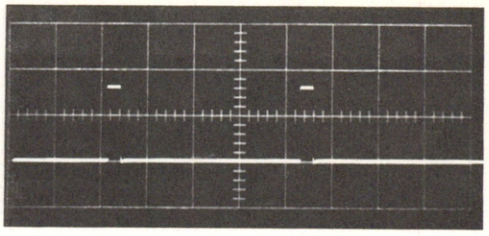
ANODE OF CR21
Sensitivity: 2V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



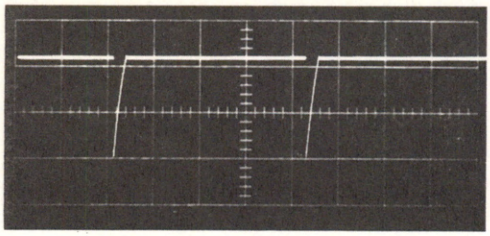
COLLECTOR OF Q19
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



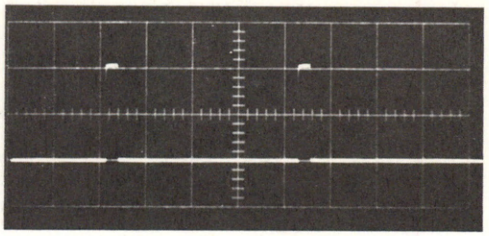
COLLECTOR OF Q18
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



BASE OF Q18
Sensitivity: 1V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



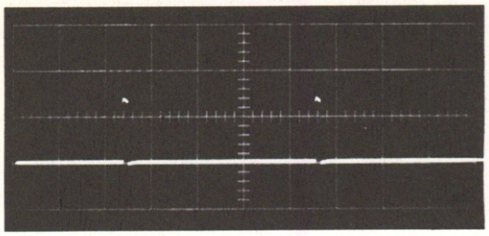
BASE OF Q17
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



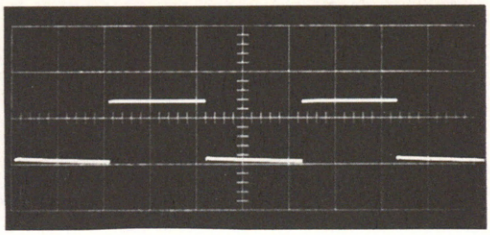
COLLECTOR OF Q17
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach

V06467

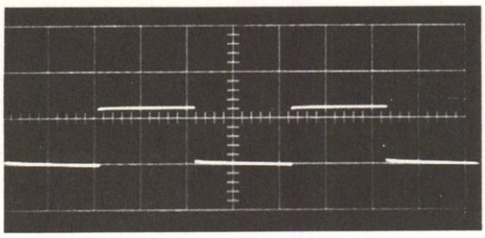
Figure 8-25. Switcher Logic Waveforms, Sheet 2 of 7



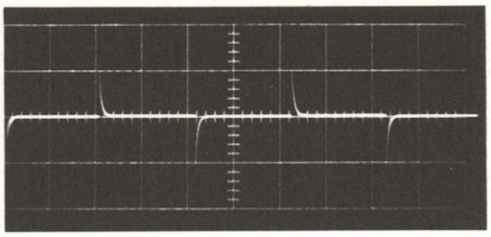
COLLECTOR OF Q16
Sensitivity: 10V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



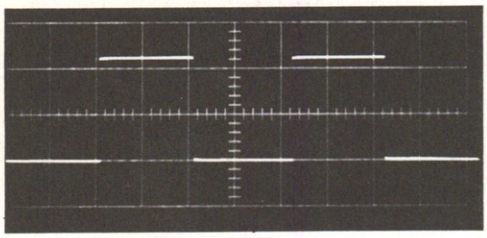
PIN 6 OF J008
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



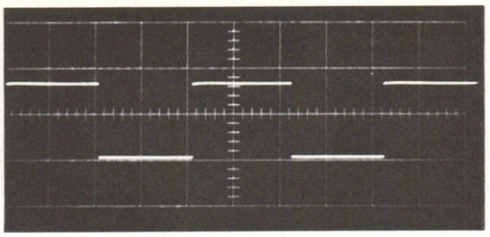
EMITTER OF Q5
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



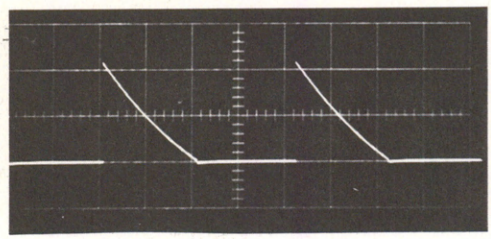
ANODE OF CR8
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



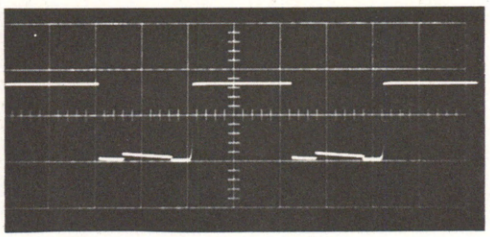
COLLECTOR OF Q8
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



BASE OF Q8
Sensitivity: 1V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



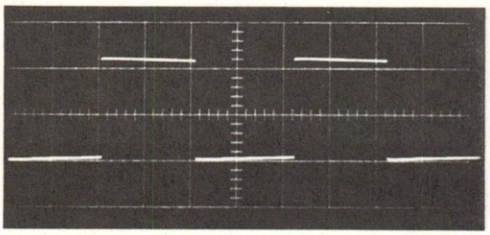
BASE OF Q7
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



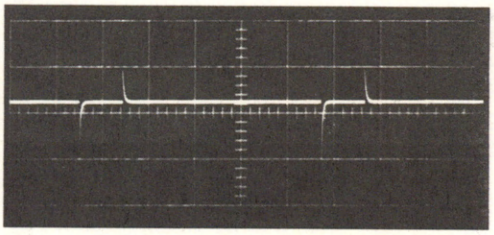
COLLECTOR OF Q7
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach

V06468

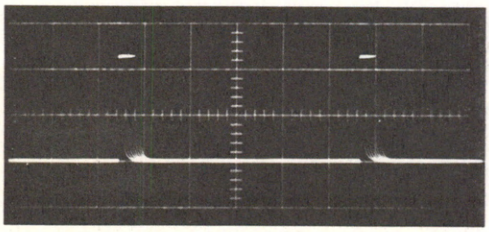
Figure 8-25. Switcher Logic Waveforms, Sheet 3 of 7



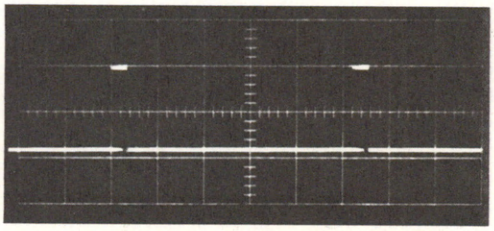
PIN 5 OF J008
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



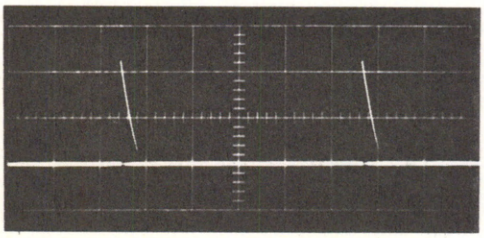
ANODE OF CR18
Sensitivity: 10V/Division
Sweep Rate: 0.2 msec/Division
Trigger: Tach



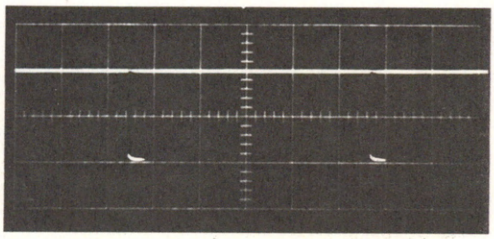
COLLECTOR OF Q30
Sensitivity: 5V/Division
Sweep Rate: 0.2 msec/Division
Trigger: Tach



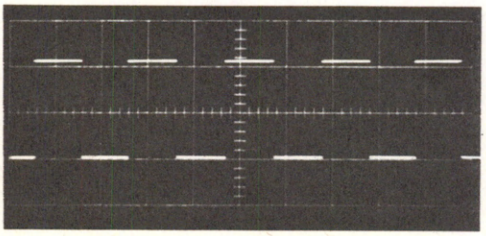
BASE OF Q30
Sensitivity: 1V/Division
Sweep Rate: 0.2 msec/Division
Trigger: Tach



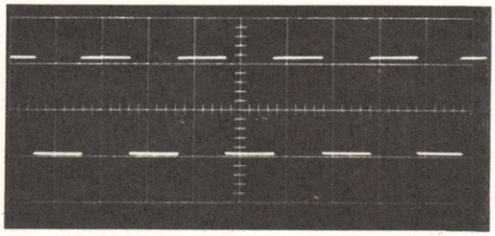
BASE OF Q31
Sensitivity: 5V/Division
Sweep Rate: 0.2 msec/Division
Trigger: Tach



COLLECTOR OF Q31
Sensitivity: 5V/Division
Sweep Rate: 0.2 msec/Division
Trigger: Tach



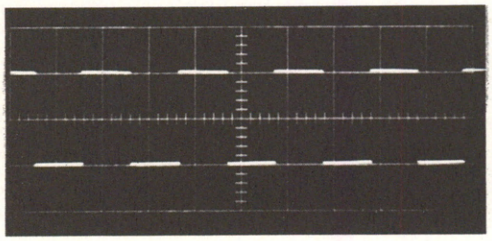
COLLECTOR OF Q34
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



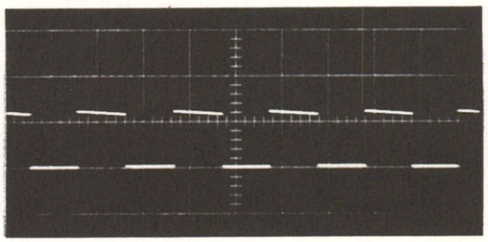
COLLECTOR OF Q33
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach

V06469

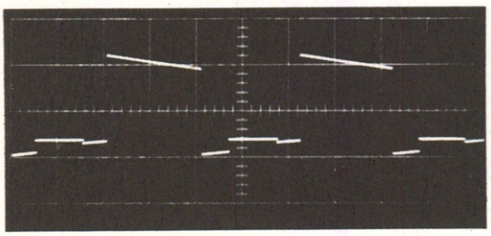
Figure 8-25. Switcher Logic Waveforms, Sheet 4 of 7



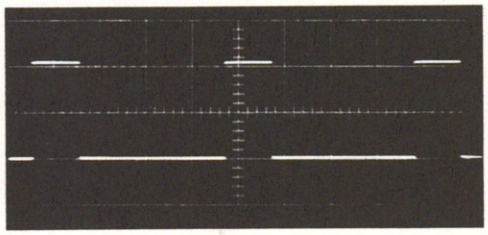
PIN 14 OF J008
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



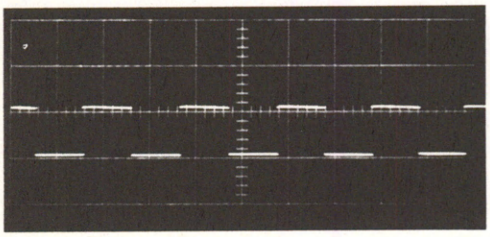
BASE OF Q12
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



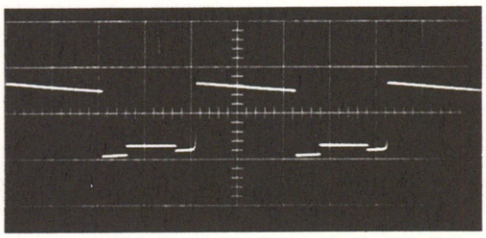
BASE OF Q11
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



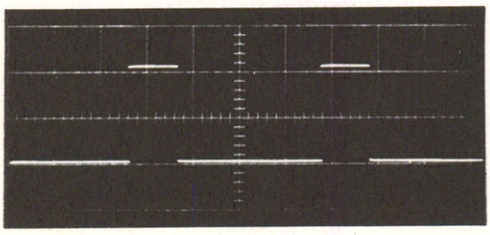
PIN 4 OF J008
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



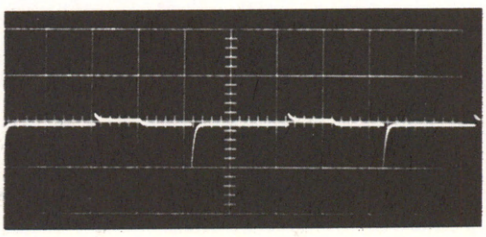
BASE OF Q13
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



BASE OF Q14
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



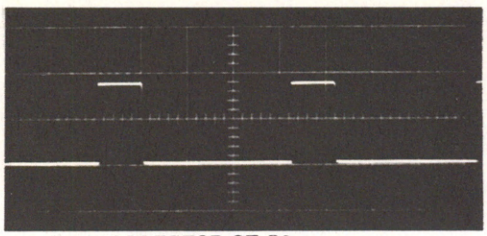
PIN 3 OF J008
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



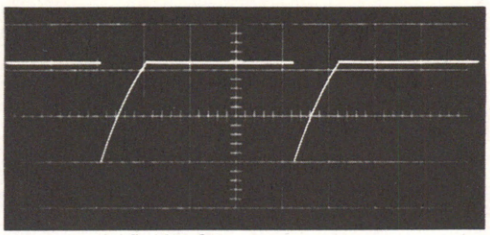
ANODE OF CR4
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach

V06470

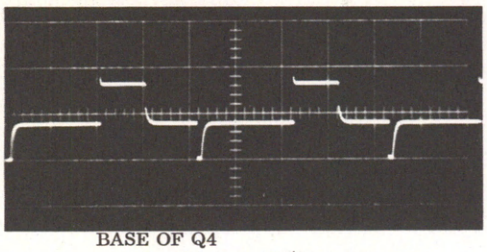
Figure 8-25. Switcher Logic Waveforms, Sheet 5 of 7



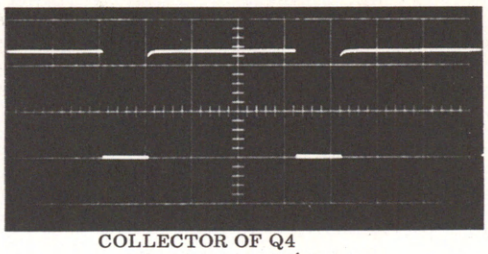
COLLECTOR OF Q3
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



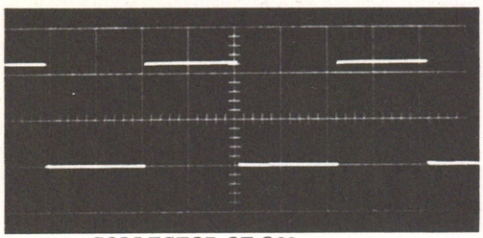
BASE OF Q3
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



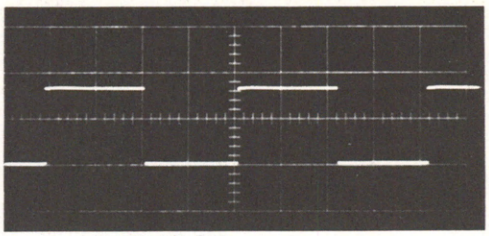
BASE OF Q4
Sensitivity: 1V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



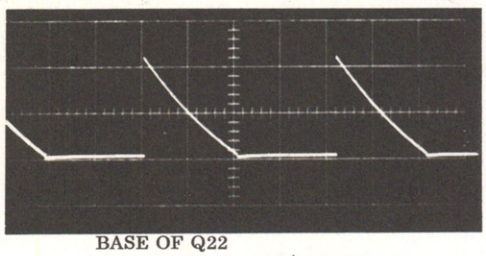
COLLECTOR OF Q4
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



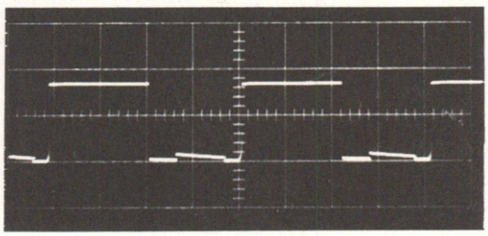
COLLECTOR OF Q23
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



BASE OF Q23
Sensitivity: 1V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



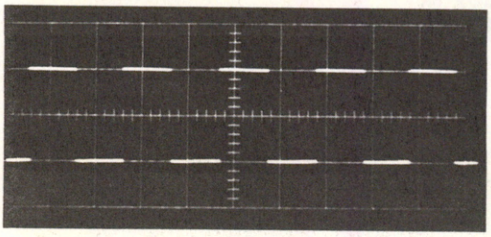
BASE OF Q22
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



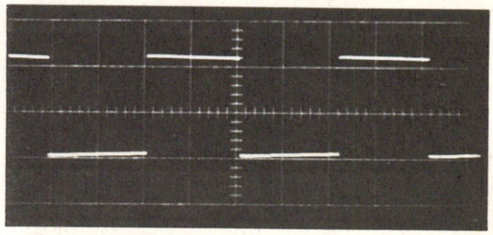
COLLECTOR OF Q22
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach

V06471

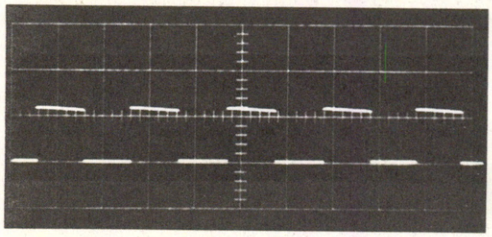
Figure 8-25. Switcher Logic Waveforms, Sheet 6 of 7



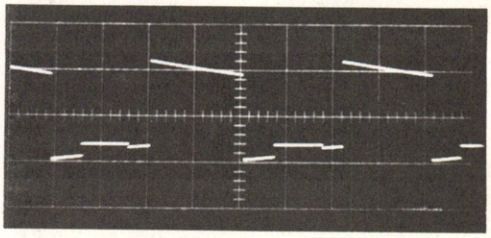
PIN 19 OF J008
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



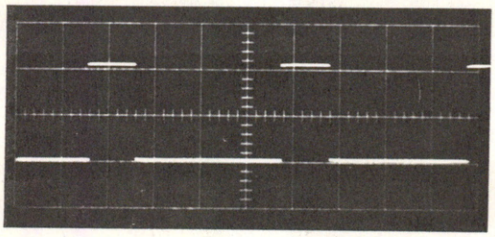
PIN 18 OF J008
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



BASE OF Q39
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



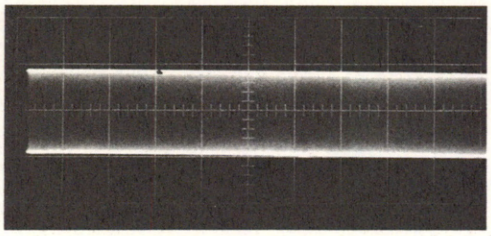
BASE OF Q40
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach



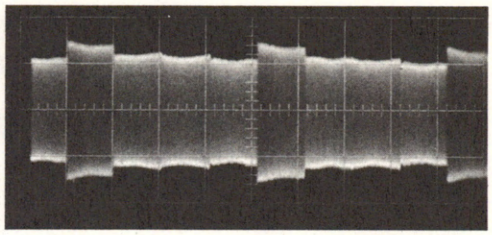
PIN 17 OF J008
Sensitivity: 5V/Division
Sweep Rate: 1 msec/Division
Trigger: Tach

V06472

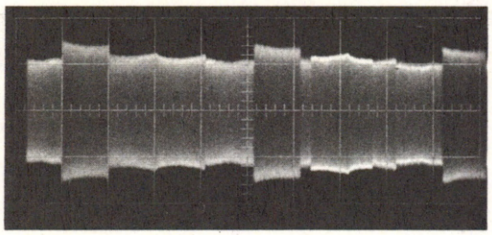
Figure 8-25. Switcher Logic Waveforms, Sheet 7 of 7



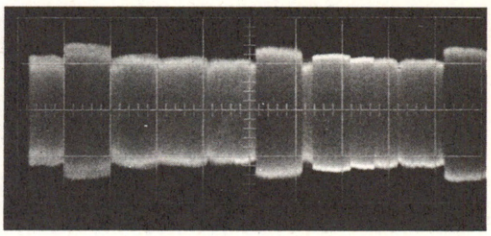
PIN 8 OF J009
Sensitivity: 0.2V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



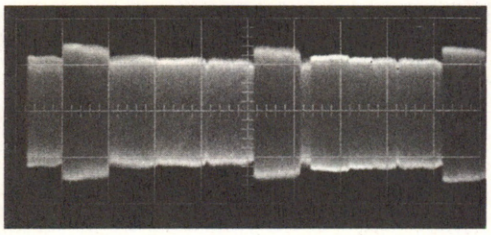
PIN 4 OF J009
Sensitivity: 0.2V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



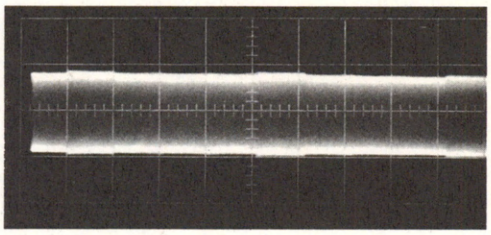
BASE OF Q5
Sensitivity: 0.2V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



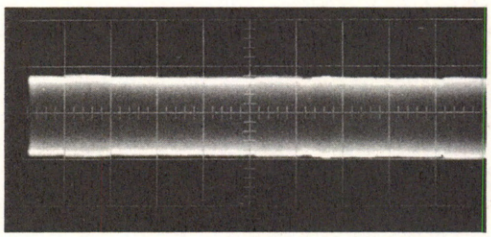
BASE OF Q11
Sensitivity: 0.2V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



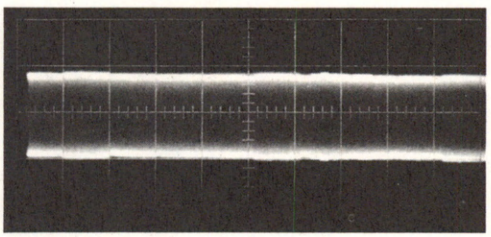
BASE OF Q4
Sensitivity: 0.2V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



ANODE OF CR4
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



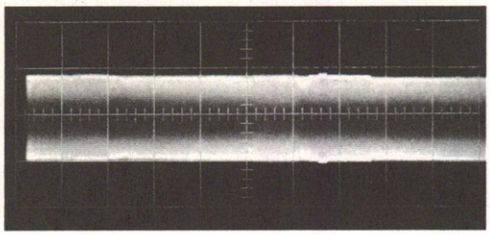
ANODE OF CR3
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



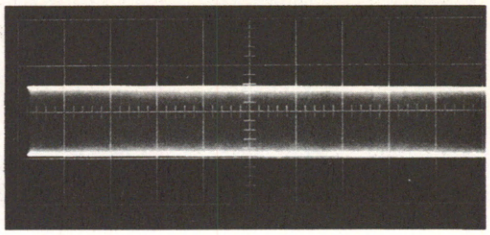
BASE OF Q14
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync

V06426

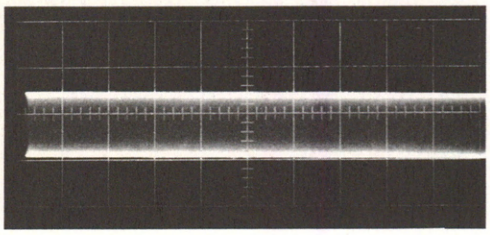
Figure 8-26. Demodulator Waveforms, Sheet 1 of 3



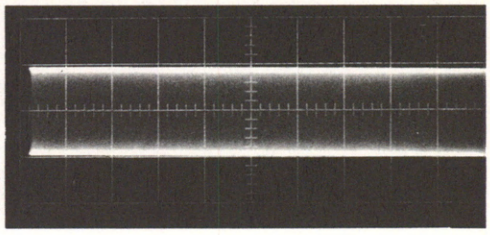
BASE OF Q13
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



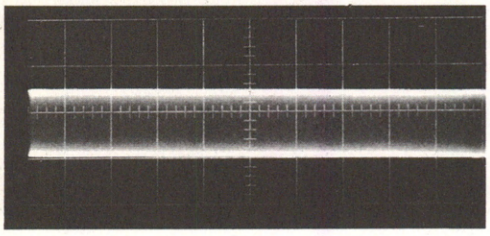
BASE OF Q17
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



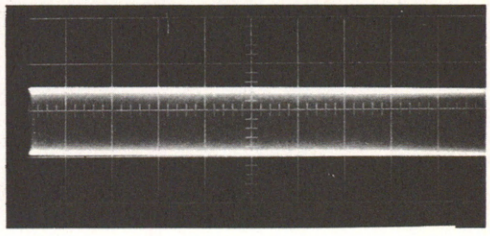
BASE OF Q20
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



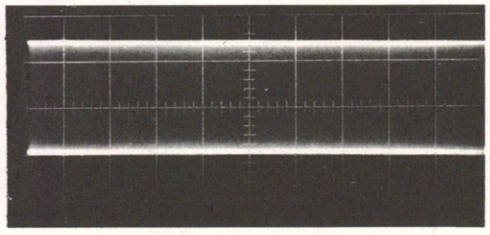
COLLECTOR OF Q17
Sensitivity: 0.25V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



BASE OF Q21
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



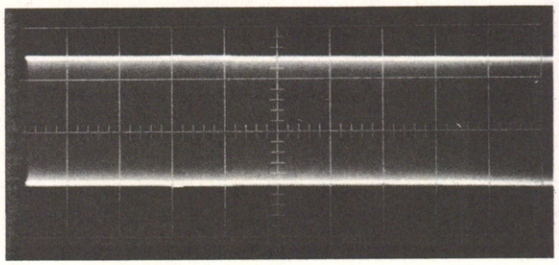
BASE OF Q28
Sensitivity: 0.5V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



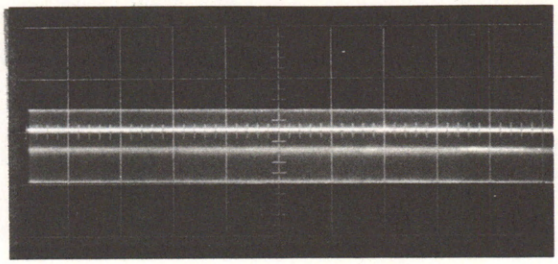
EMITTER OF Q22
Sensitivity: 1V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync

V06427

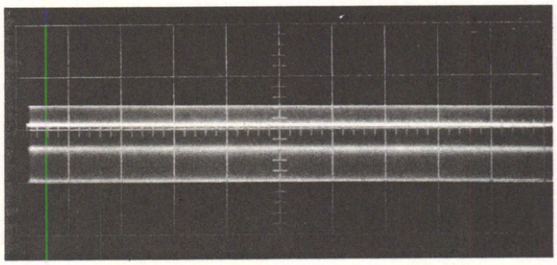
Figure 8-26. Demodulator Waveforms, Sheet 2 of 3



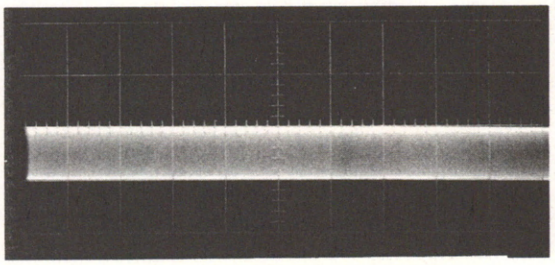
EMITTER OF Q29
Sensitivity: 1V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



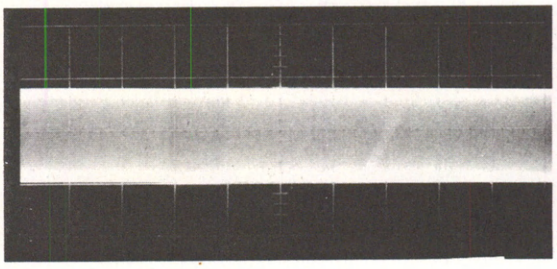
JUNCTION OF CR16 AND CR17
Sensitivity: 1V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



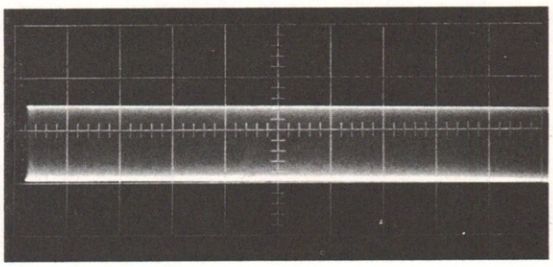
JUNCTION OF CR18 AND CR19
Sensitivity: 1V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



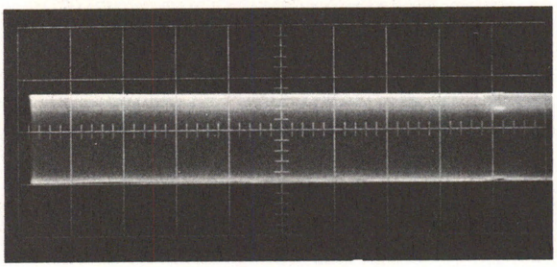
BASE OF Q23
Sensitivity: 1V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



BASE OF Q27
Sensitivity: 1V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



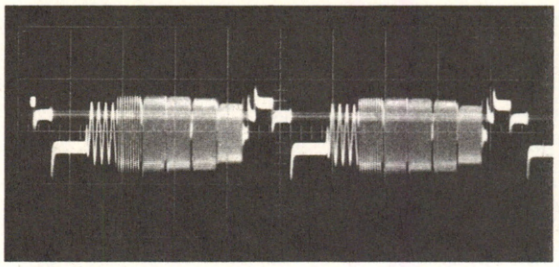
PIN 16 OF J009
Sensitivity: 1V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



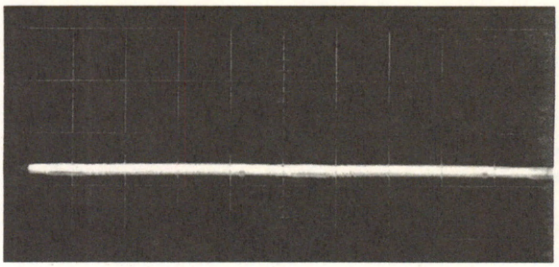
PIN 18 OF J009
Sensitivity: 1V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync

V06428

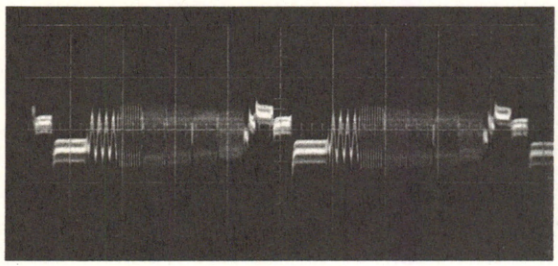
Figure 8-26. Demodulator Waveforms, Sheet 3 of 3



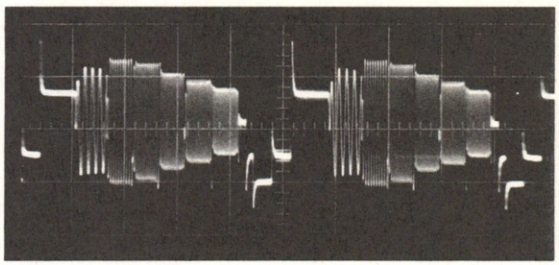
PIN 20 of J011
Sensitivity: 0.1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



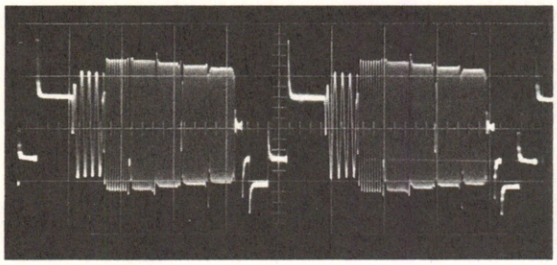
PIN 22 of J011
Sensitivity: 0.1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



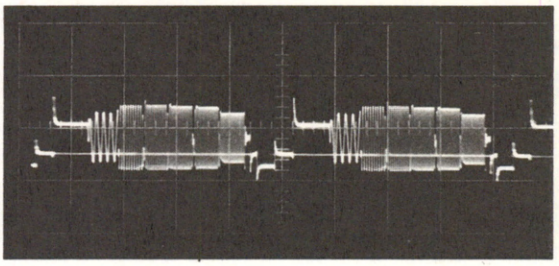
COLLECTOR OF Q26
Sensitivity: 0.5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



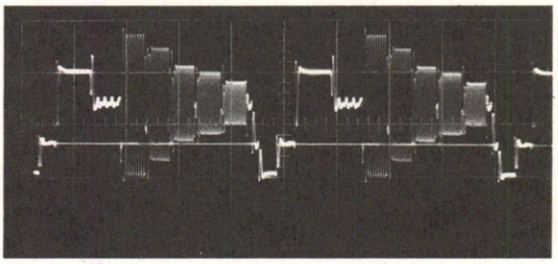
COLLECTOR OF Q29
Sensitivity: 0.2V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



BASE OF Q27
Sensitivity: 0.2V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



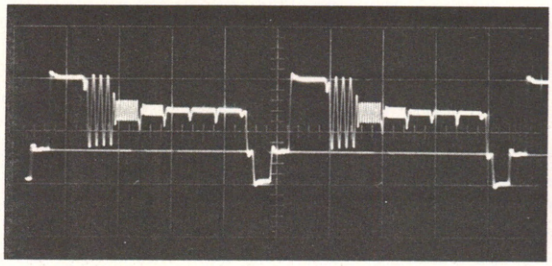
EMITTER OF Q22
Sensitivity: 5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



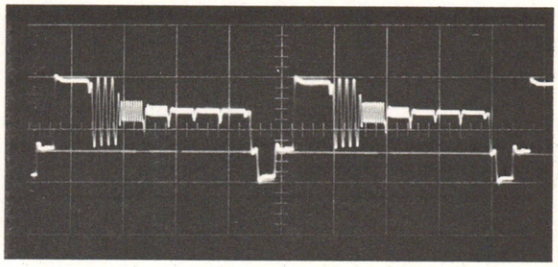
JUNCTION OF C30 and L5
Sensitivity: 2V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync

V06450

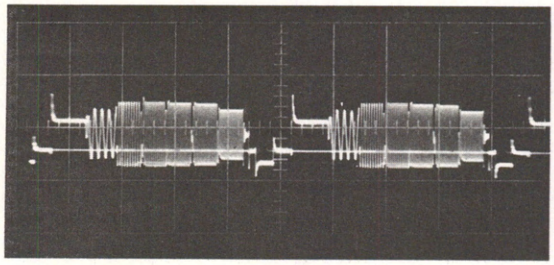
Figure 8-27. Output Video Waveforms, Sheet 1 of 5



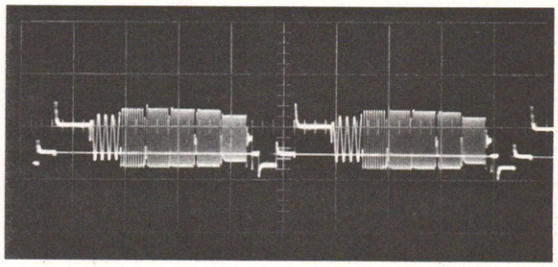
JUNCTION OF C29 AND L5
Sensitivity: 2V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



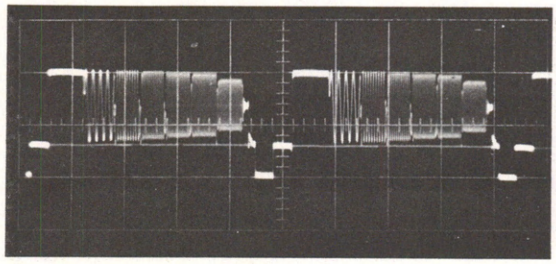
EMITTER OF Q19
Sensitivity: 2V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



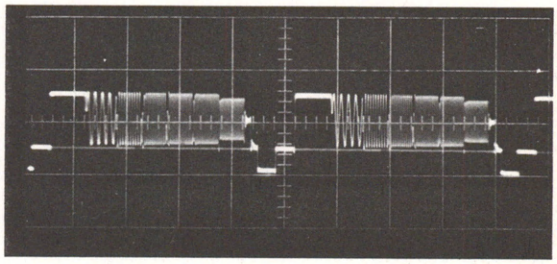
BASE OF Q17
Sensitivity: 5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



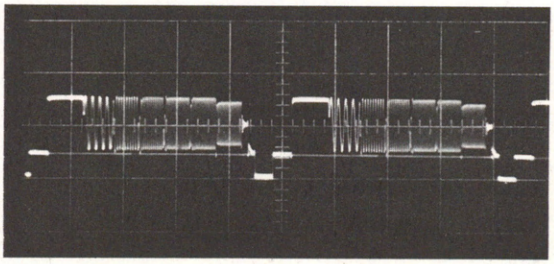
PIN 15 OF J011
Sensitivity: 5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



PIN 2 OF J011
Sensitivity: 0.1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



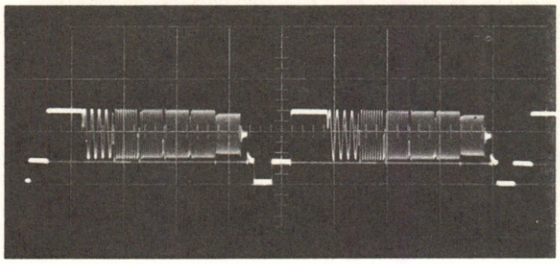
COLLECTOR OF Q3
Sensitivity: 1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



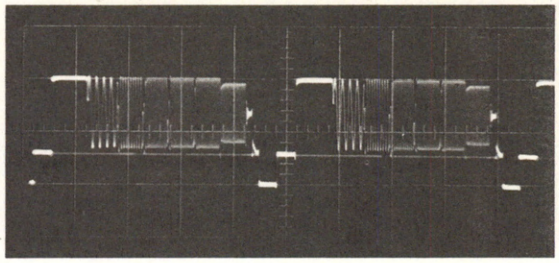
EMITTER OF Q1
Sensitivity: 1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync

V06451

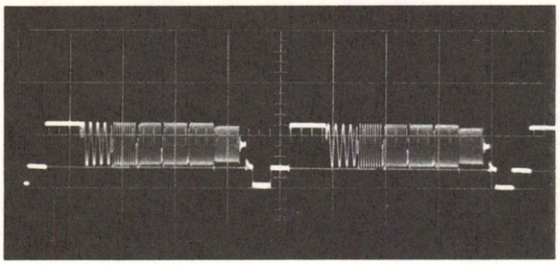
Figure 8-27. Output Video Waveforms, Sheet 2 of 5



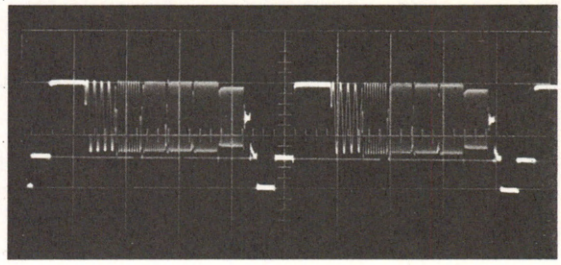
BASE OF Q4
Sensitivity: 0.5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



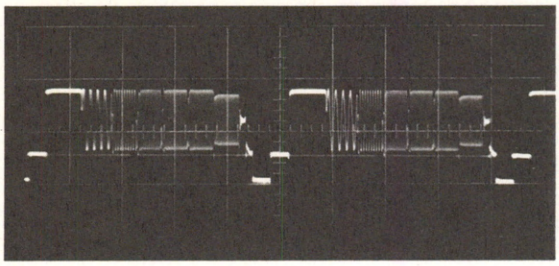
COLLECTOR OF Q5
Sensitivity: 1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



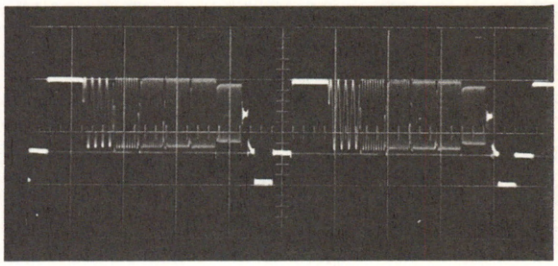
BASE OF Q5
Sensitivity: 0.5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



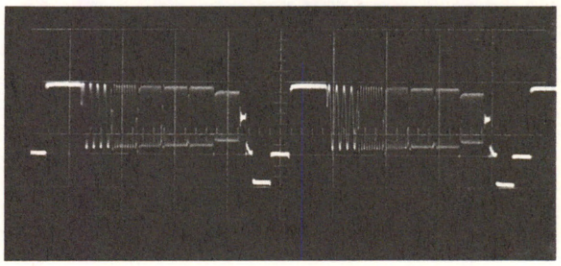
BASE OF Q2
Sensitivity: 1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



PIN 7 OF J011
Sensitivity: 1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



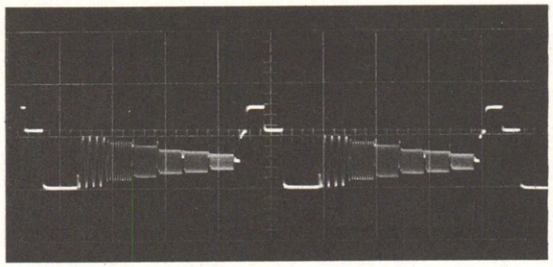
PIN 8 OF J011
Sensitivity: 0.5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



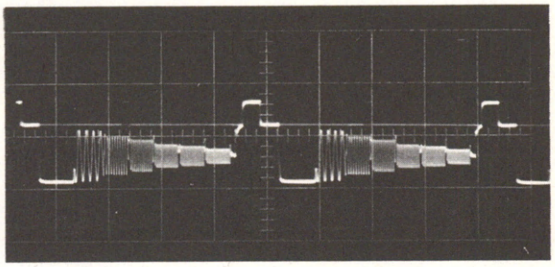
BASE OF Q16
Sensitivity: 1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync

V06452

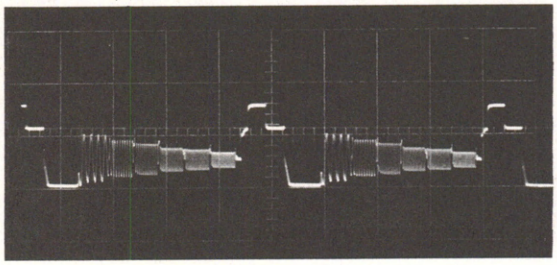
Figure 8-27. Output Video Waveforms, Sheet 3 of 5



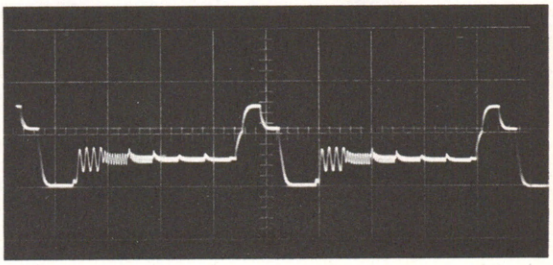
EMITTER OF Q15
Sensitivity: 5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



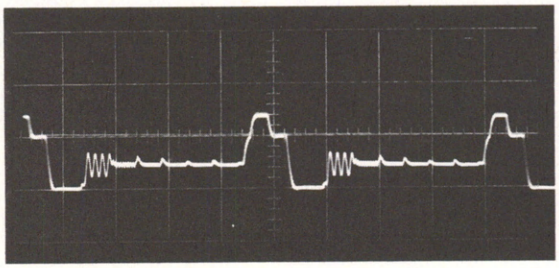
PIN 11 OF J011
Sensitivity: 5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



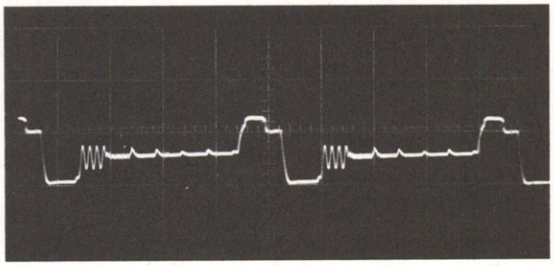
EMITTER OF Q11
Sensitivity: 5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



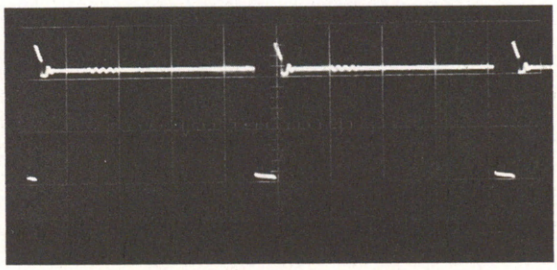
JUNCTION OF R36 AND R37
Sensitivity: 5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



EMITTER OF Q10
Sensitivity: 5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



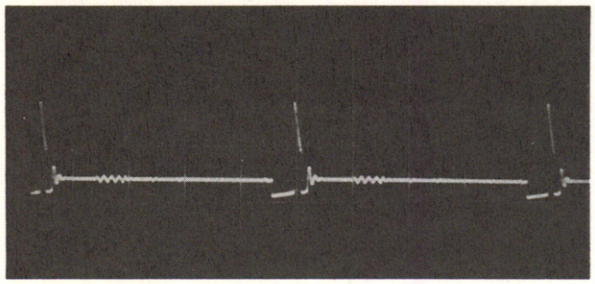
BASE OF Q9
Sensitivity: 5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



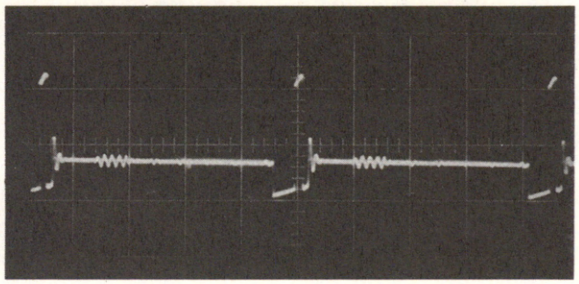
COLLECTOR OF Q9
Sensitivity: 5V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync

V06453

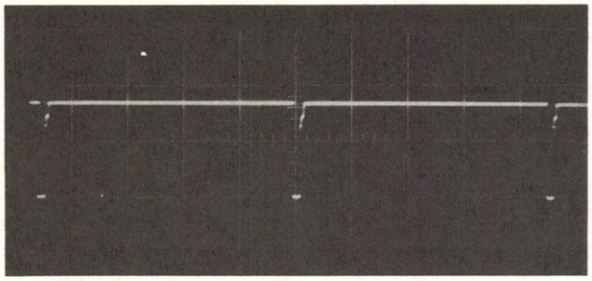
Figure 8-27. Output Video Waveforms, Sheet 4 of 5



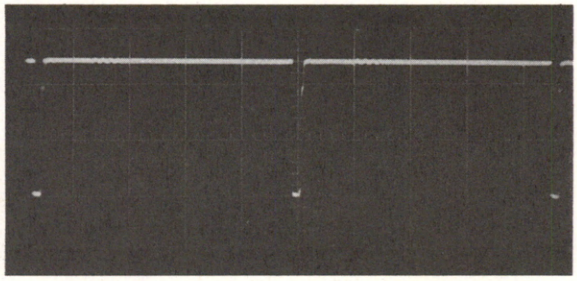
JUNCTION OF R32 AND R52
Sensitivity: 2V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



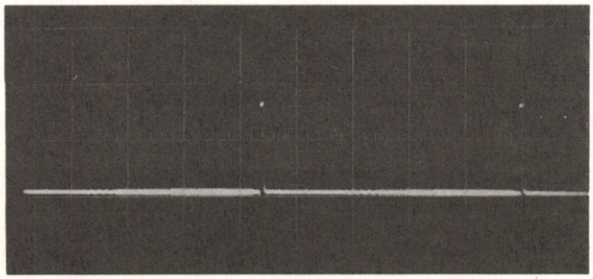
BASE OF Q8
Sensitivity: 1V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



COLLECTOR OF Q8
Sensitivity: 10V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



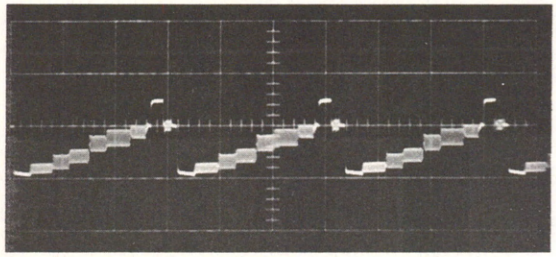
BASE OF Q20
Sensitivity: 2V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync



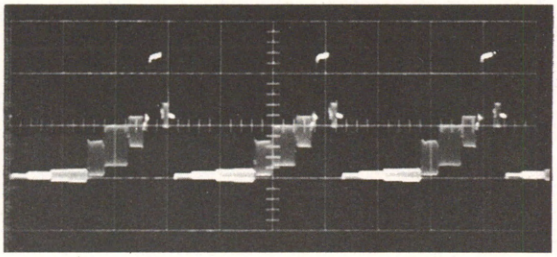
PIN 18 OF J011
Sensitivity: 2V/Division
Sweep Rate: 1/2 Horizontal Rate
Trigger: Sync

06454

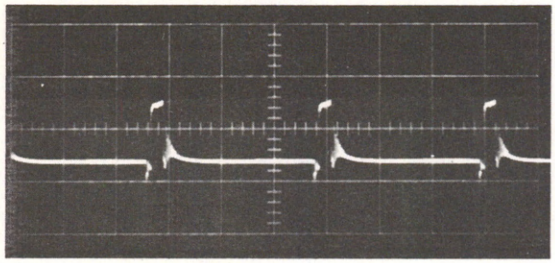
Figure 8-27. Output Video Waveforms, Sheet 5 of 5



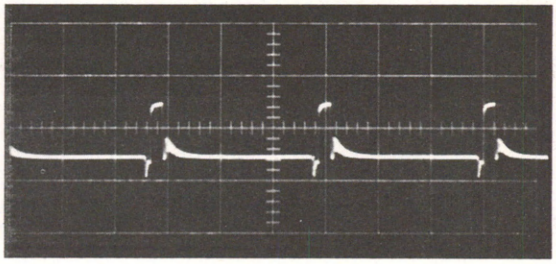
PIN 4 OF J012
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



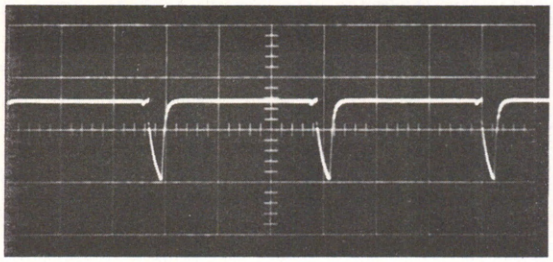
EMITTER OF Q13
Sensitivity: 2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



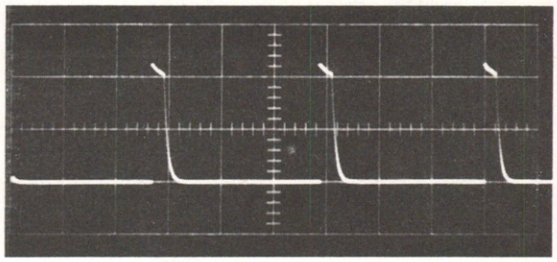
EMITTER 2 OF Q12
Sensitivity: 2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



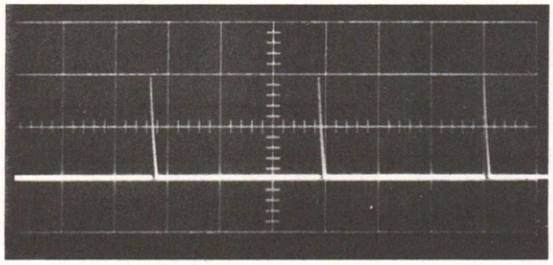
BASE OF Q11
Sensitivity: 2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



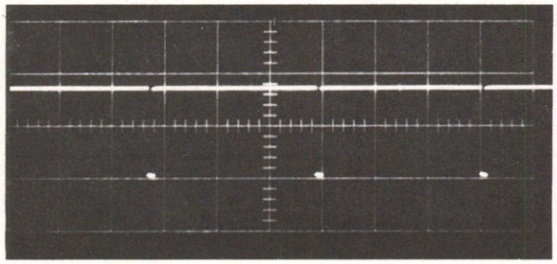
BASE OF Q10
Sensitivity: 2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



COLLECTOR OF Q10
Sensitivity: 10V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync

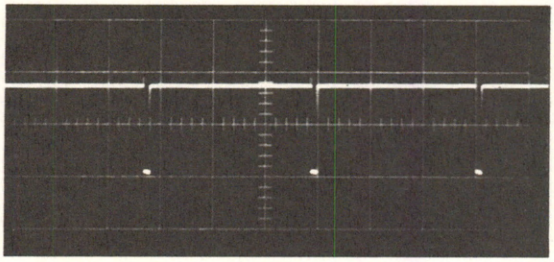


BASE OF Q9
Sensitivity: 10V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync

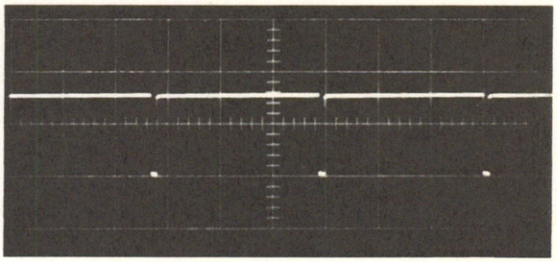


COLLECTOR OF Q9
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync

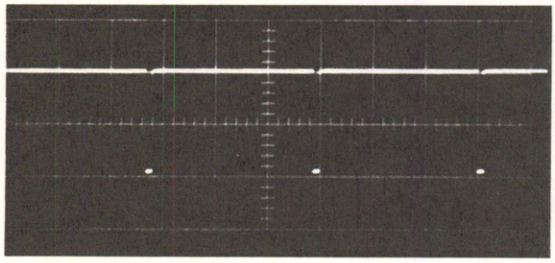
Figure 8-28. Sync Processing Waveforms, Sheet 1 of 6



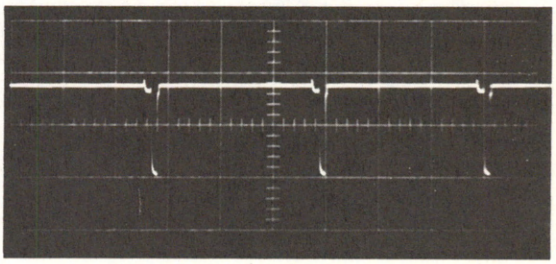
EMITTER OF Q8
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



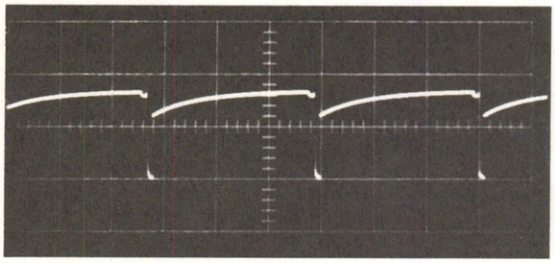
EMITTER OF Q7
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



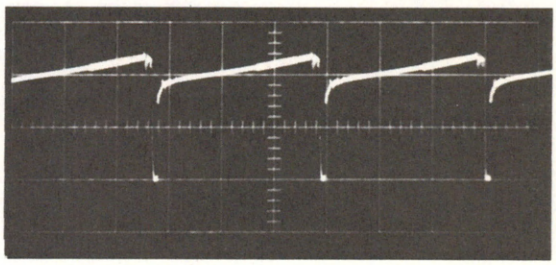
PIN 2 OF J012
Sensitivity: 2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



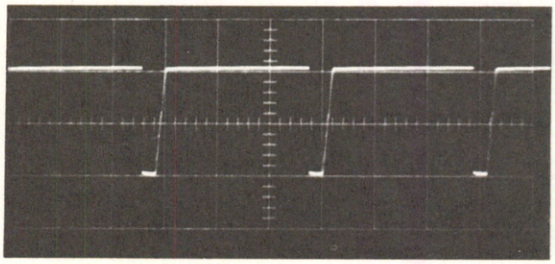
COLLECTOR OF Q5
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



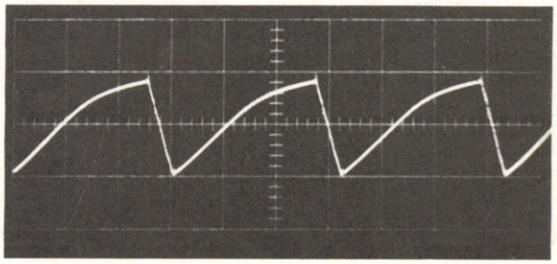
EMITTER OF Q6
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



BASE OF Q4
Sensitivity: 0.05V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



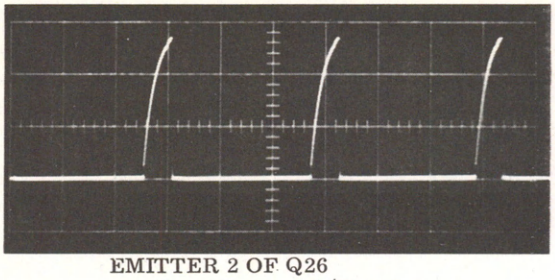
COLLECTOR OF Q4
Sensitivity: 10V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



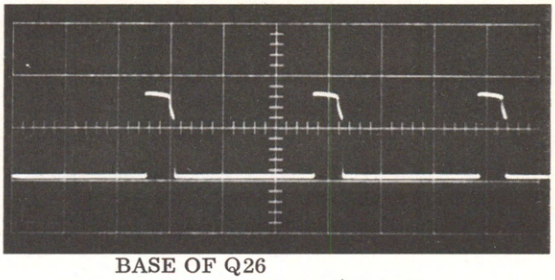
BASE OF Q2
Sensitivity: 0.1V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync

V06475

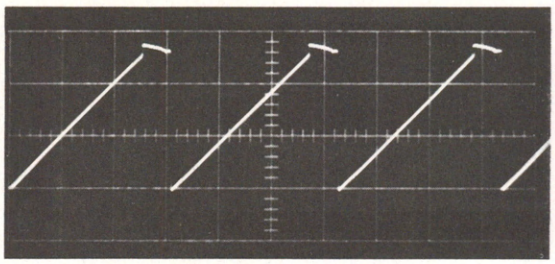
Figure 8-28. Sync Processing Waveforms, Sheet 2 of 6



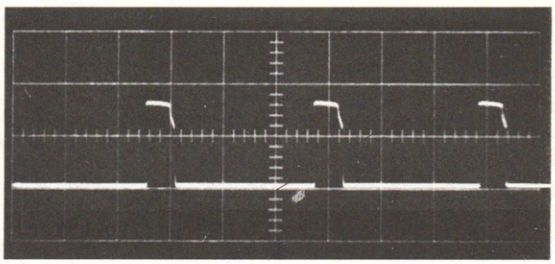
EMITTER 2 OF Q26
Sensitivity: 2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



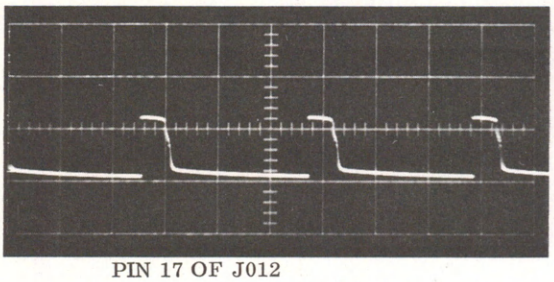
BASE OF Q26
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



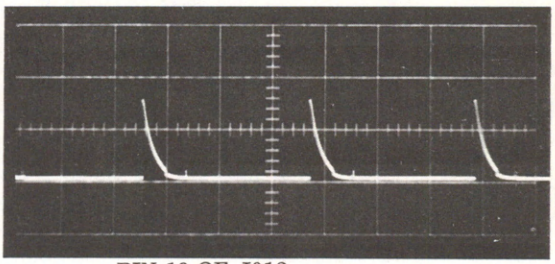
COLLECTOR OF Q27
Sensitivity: 2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



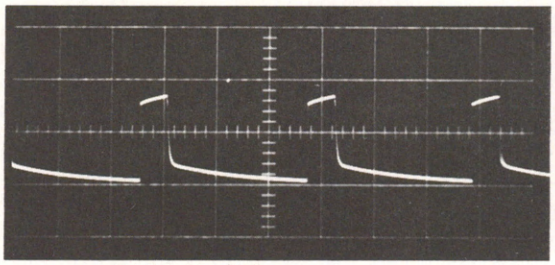
BASE OF Q29
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



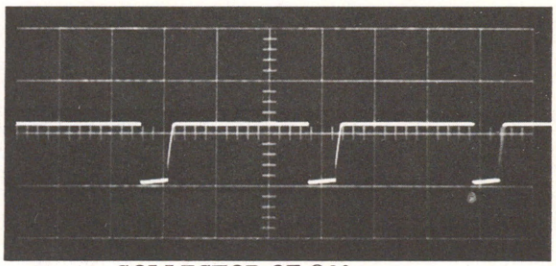
PIN 17 OF J012
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



PIN 19 OF J012
Sensitivity: 2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



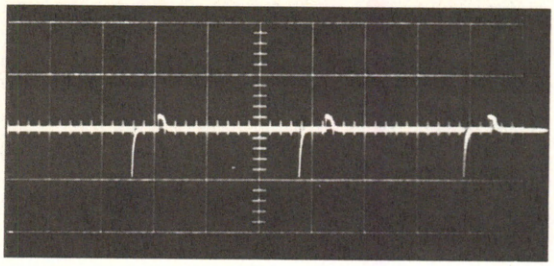
BASE OF Q30
Sensitivity: 2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



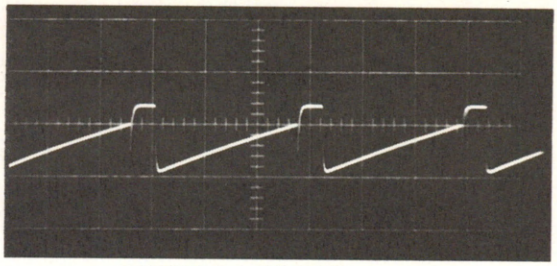
COLLECTOR OF Q30
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync

V06476

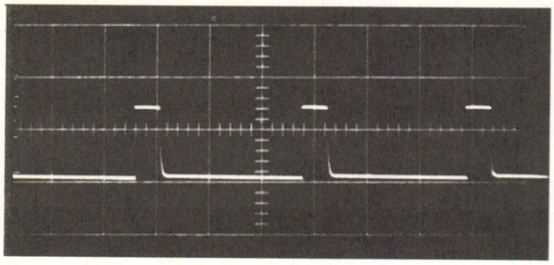
Figure 8-28. Sync Processing Waveforms, Sheet 3 of 6



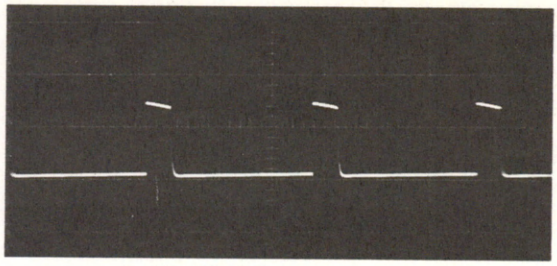
BASE OF Q31
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



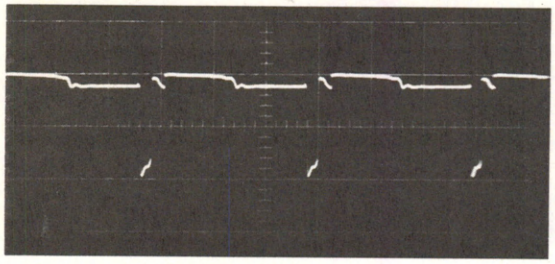
EMITTER 1 OF Q31
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



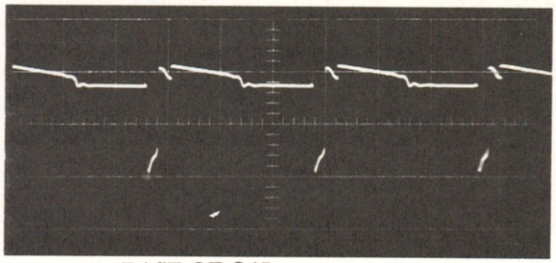
EMITTER 2 OF Q31
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



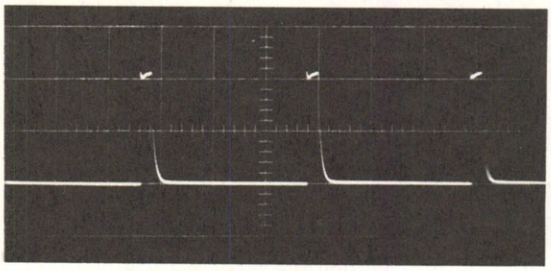
BASE OF Q32
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



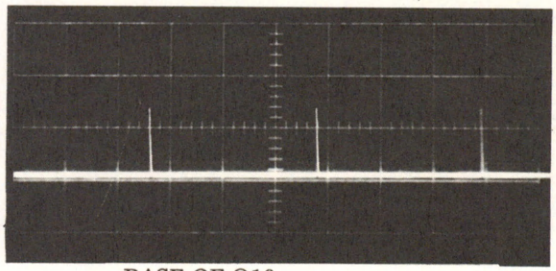
ANODE OF CR19
Sensitivity: 2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



BASE OF Q15
Sensitivity: 2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



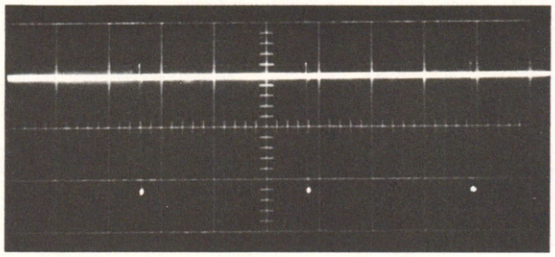
COLLECTOR OF Q15
Sensitivity: 10V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



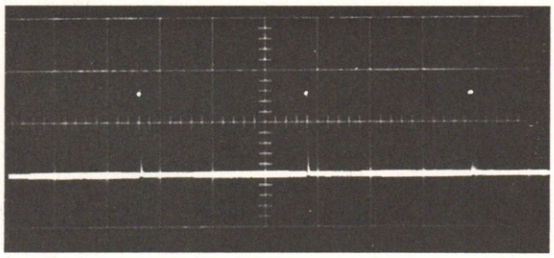
BASE OF Q16
Sensitivity: 10V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync

V06477

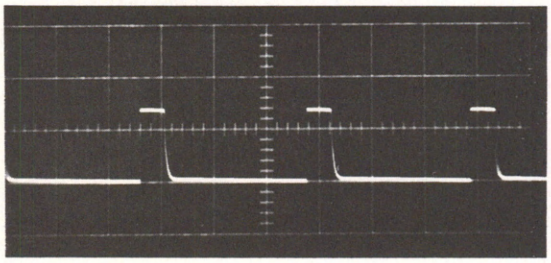
Figure 8-28. Sync Processing Waveforms, Sheet 4 of 6



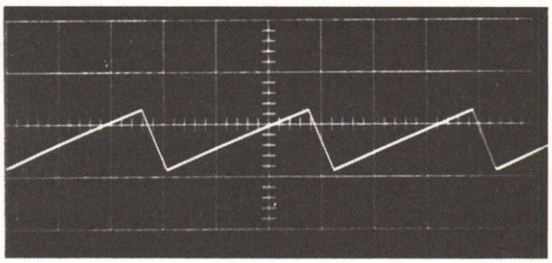
COLLECTOR OF Q16
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



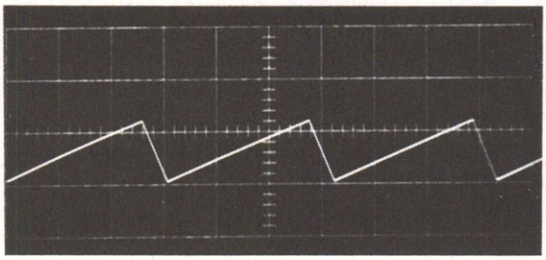
PIN 12 OF J012
Sensitivity: 2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



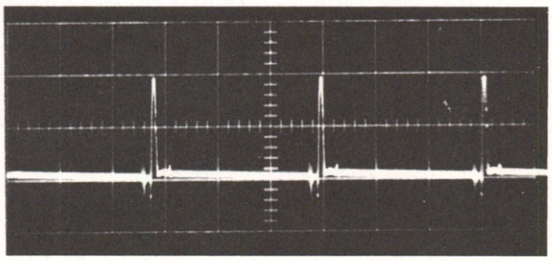
BASE OF Q33
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



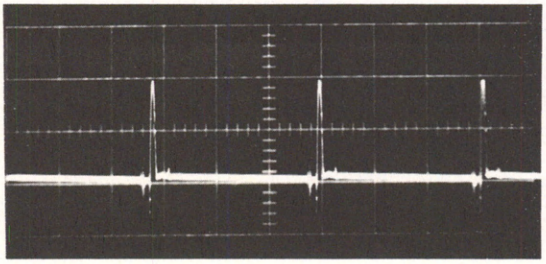
COLLECTOR OF Q33
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



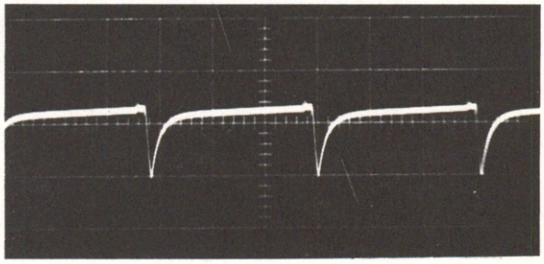
EMITTER OF Q34
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



BASE OF Q18
Sensitivity: 0.05V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



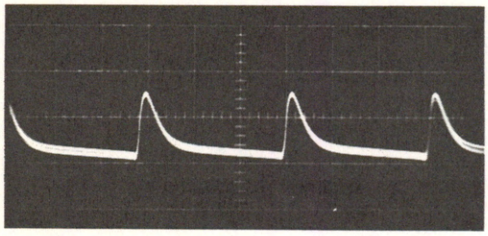
BASE OF Q19
Sensitivity: 0.05V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



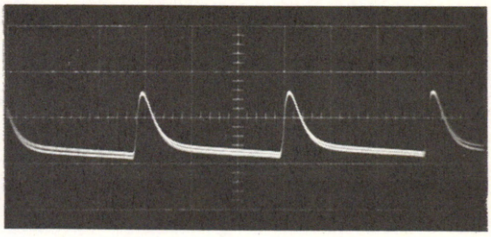
BASE OF Q20
Sensitivity: 0.2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync

V06478

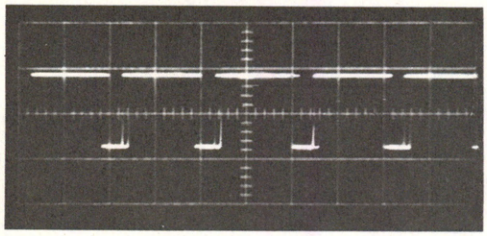
Figure 8-28. Sync Processing Waveforms, Sheet 5 of 6



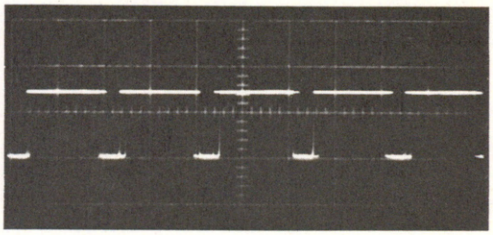
COLLECTOR OF Q20
Sensitivity: 0.5 V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



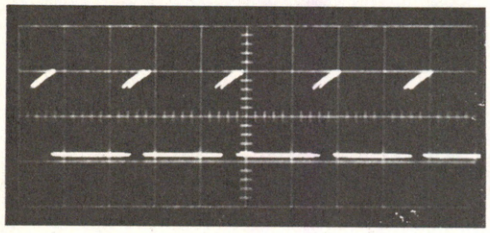
JUNCTION OF C29 AND C30
Sensitivity: 0.5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



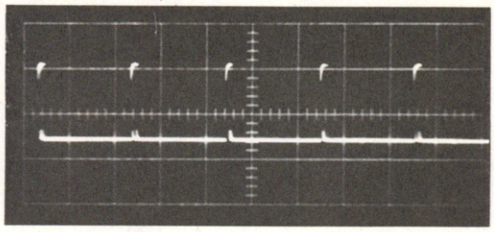
BASE OF Q23
Sensitivity: 10V/Division
Sweep Rate: 0.5 msec/Division
Trigger: Internal



BASE OF Q25
Sensitivity: 5V/Division
Sweep Rate: 0.5 msec/Division
Trigger: Internal



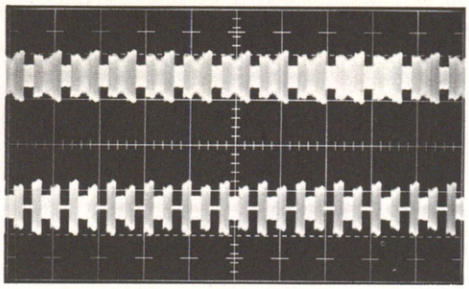
COLLECTOR OF Q25
Sensitivity: 5V/Division
Sweep Rate: 0.5 msec/Division
Trigger: Internal



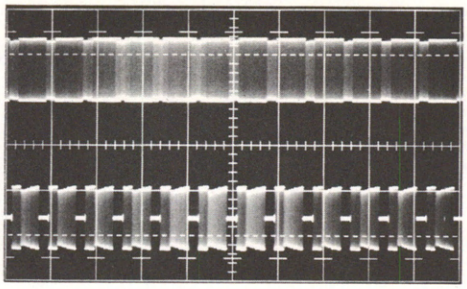
PIN 13 OF J012
Sensitivity: 5V/Division
Sweep Rate: 0.5 msec/Division
Trigger: Internal

V06481

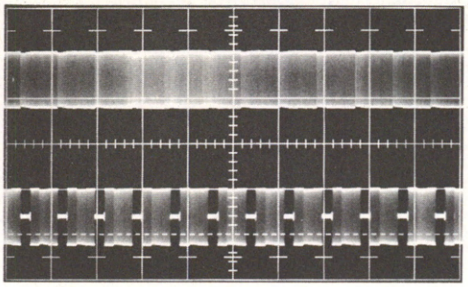
Figure 8-28. Sync Processing Waveforms, Sheet 6 of 6



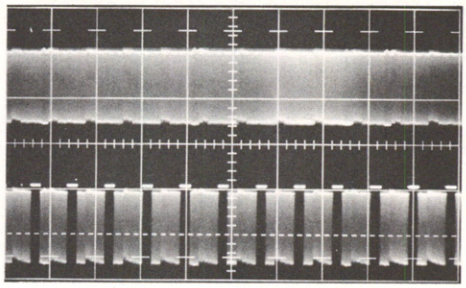
MODULE PIN 4
1) Normal Input
2) Input with Dropout



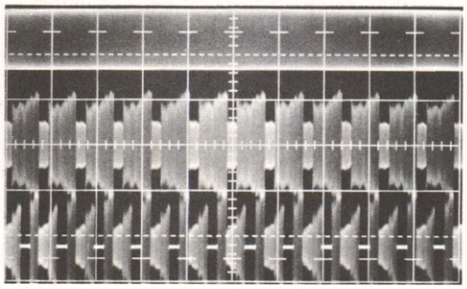
CATHODE OF CR1
1) Normal Playback
2) Dropout Present



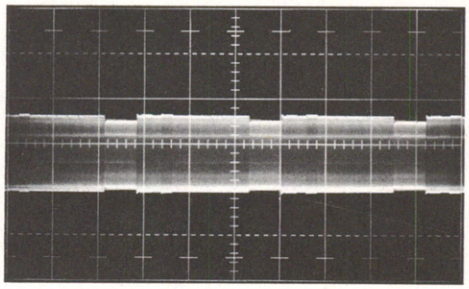
CATHODE OF CR7
1) Normal Playback
2) Dropout Present



BASE OF Q6
1) Normal Playback
2) Dropout Present



COLLECTOR OF Q21
1) Normal EE
2) Normal Playback
3) Dropout Present

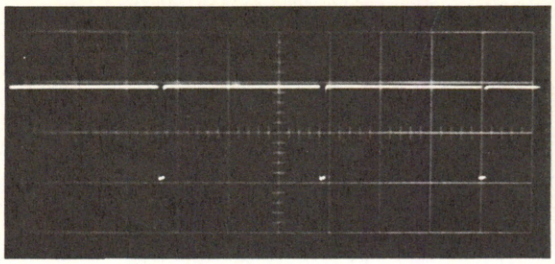


MODULE PIN 11

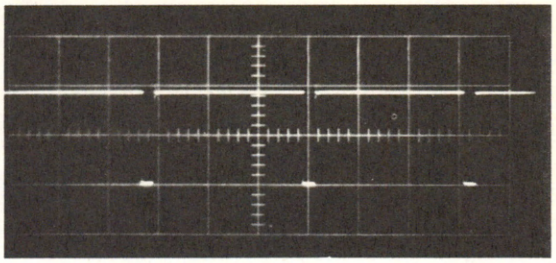
NOTE: ONE HEAD CHANNEL AMPLITUDE DECREASED FOR IDENTIFICATION

VO8739

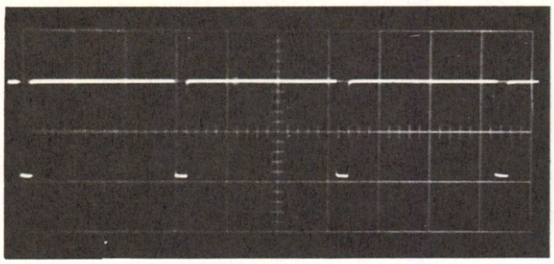
Figure 8-29. Dropout Sensor Waveforms



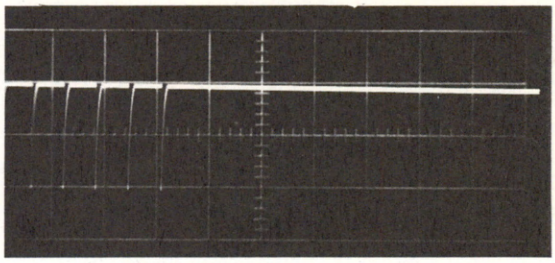
MODULE 1 TP1
Sensitivity: 2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



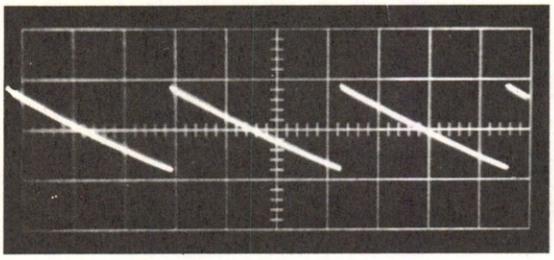
MODULE 1 TP2
Sensitivity: 2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Internal



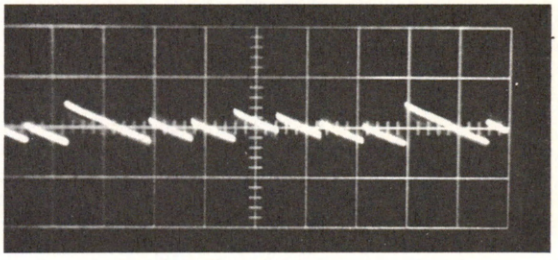
MODULE 1 TP4
Sensitivity: 2V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



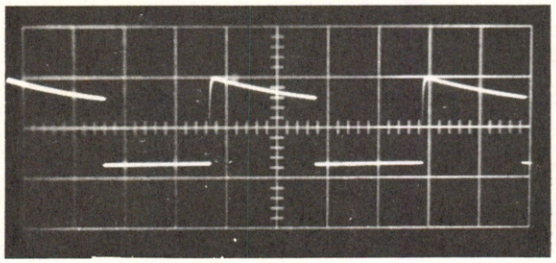
MODULE 2 TP1
Sensitivity: 5V/Division
Sweep Rate: 50 μsec/Division
Trigger: Internal



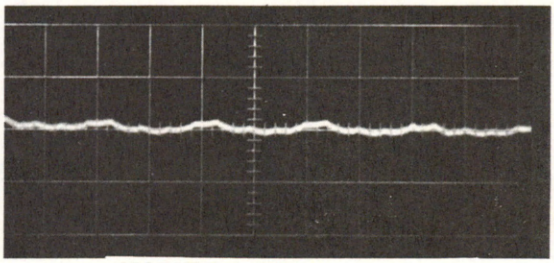
MODULE 3 TP1
Sensitivity: 0.2V/Division
Sweep Rate: 5 msec/Division
Trigger: Sync



MODULE 3 TP3
Sensitivity: .05V/Division
Sweep Rate: 5 msec/Division
Trigger: Sync



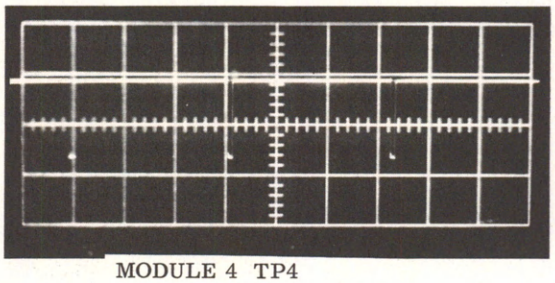
MODULE 3 TP4
Sensitivity: 2V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



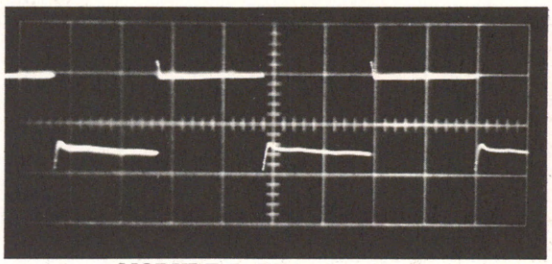
MODULE 4 TP1
Sensitivity: 0.5V/Division
Sweep Rate: 2 msec/Division
Trigger: Module 2 TP1

V06717

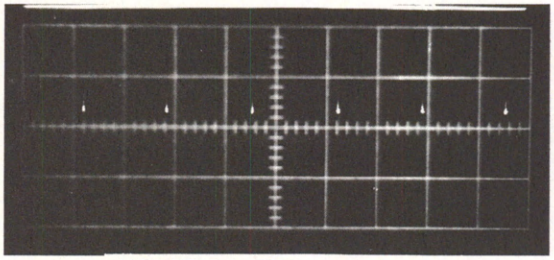
Figure 8-30. Intersync Servo Waveforms, Sheet 1 of 3



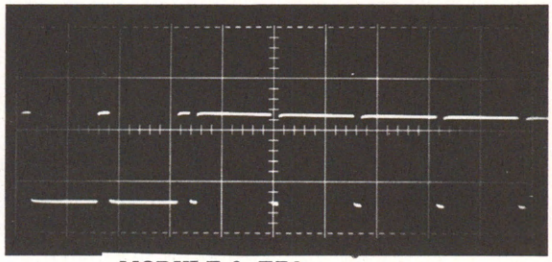
MODULE 4 TP4
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



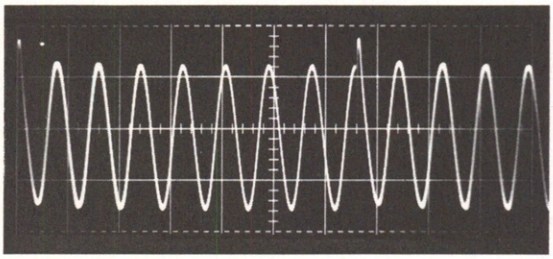
MODULE 7 TP4
Sensitivity: 10V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



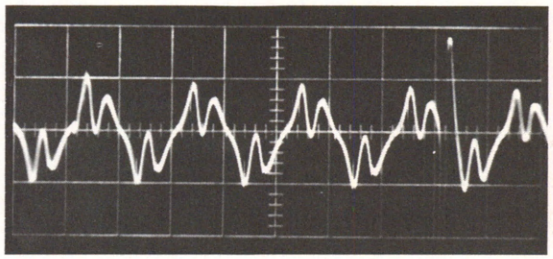
MODULE 8 TP2
Sensitivity: 5V/Division
Sweep Rate: 10 msec/Division
Trigger: Sync



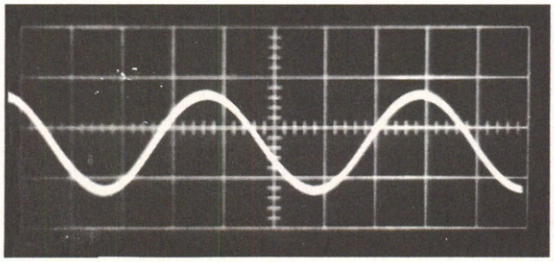
MODULE 8 TP3
Sensitivity: 2V/Division
Sweep Rate: 50 μsec/Division
Trigger: Sync



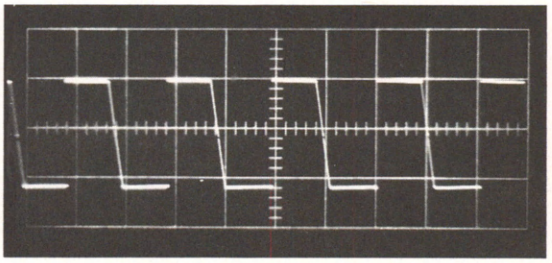
MODULE 10 TP1
Sensitivity: 0.5V/Division
Sweep Rate: 5 msec/Division
Trigger: Sync



MODULE 10 TP2
Sensitivity: 1V/Division
Sweep Rate: 2 msec/Division
Trigger: Internal



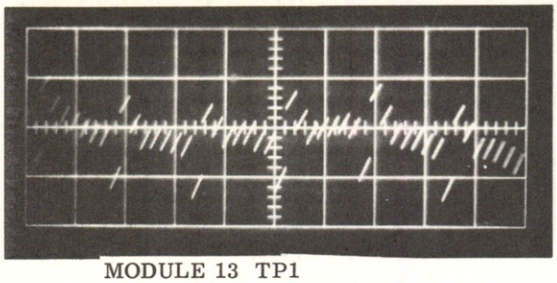
MODULE 11 TP6
Sensitivty: 0.2V/Division
Sweep Rate: 1 msec/Division
Trigger: Sync



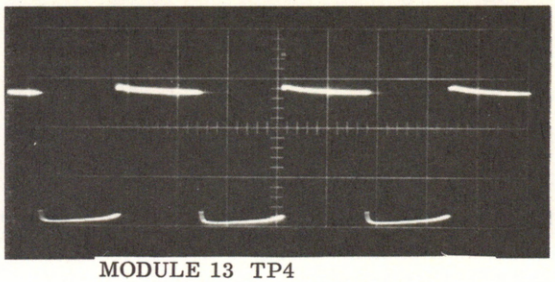
MODULE 12 TP4
Sensitivity: 10V/Division
Sweep Rate: 2 msec/Division
Trigger: Sync

V06718

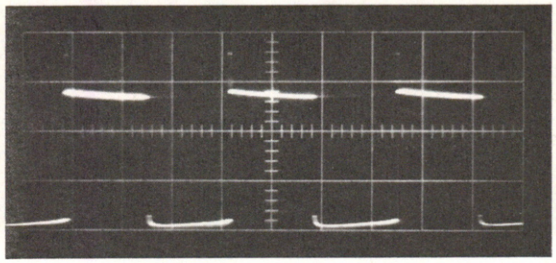
Figure 8-30. Intersync Servo Waveforms, Sheet 2 of 3



MODULE 13 TP1
Sensitivity: 0.1V/Division
Sweep Rate: 20 msec/Division
Trigger: Sync



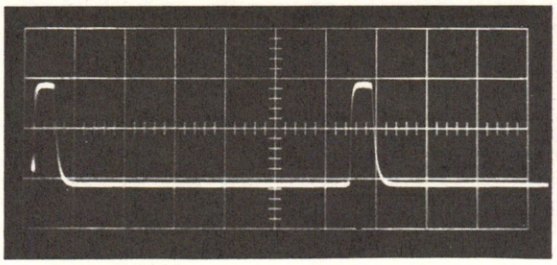
MODULE 13 TP4
Sensitivity: 5V/Division
Sweep Rate: 5 msec/Division
Trigger: Sync



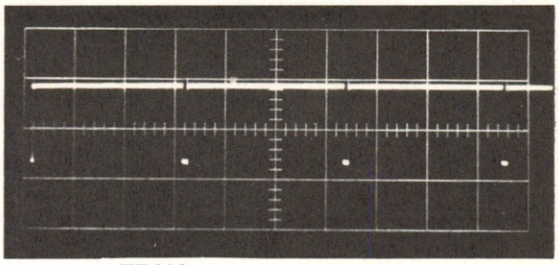
MODULE 13 TP5
Sensitivity: 5V/Division
Sweep Rate: 5 msec/Division
Trigger: Sync

V06719

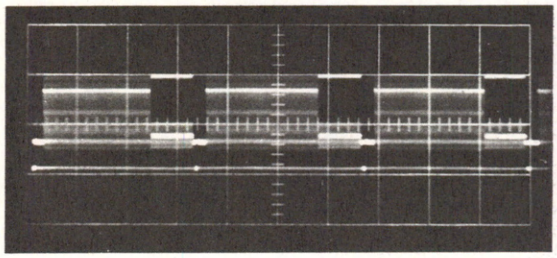
Figure 8-30. Intersync Servo Waveforms, Sheet 3 of 3



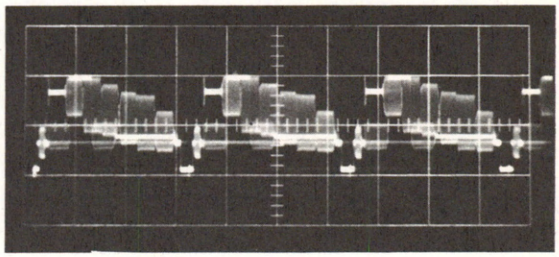
TP001
Sensitivity: 1V/Division
Sweep Rate: 10 μsec/Division
Trigger: Sync



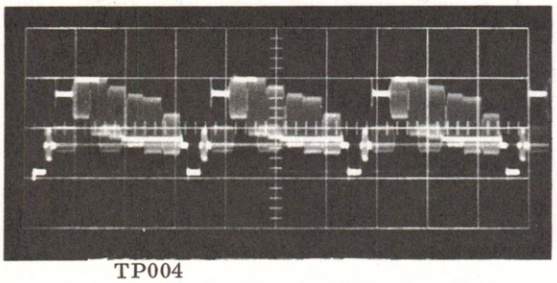
TP002
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



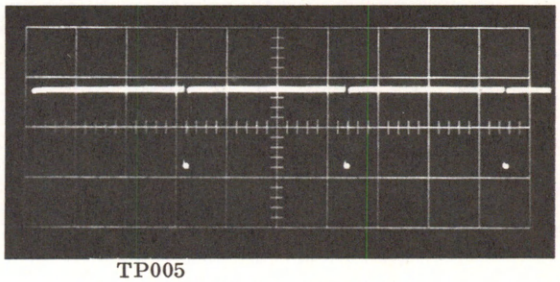
TP003
Sensitivity: 0.5V/Division
Sweep Rate: 5 msec/Division
Trigger: Internal



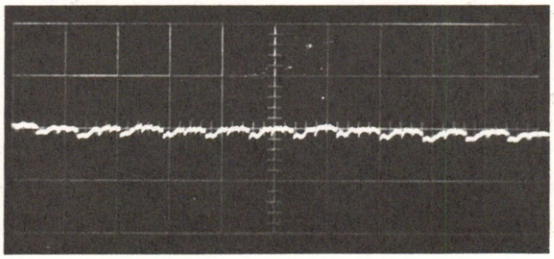
TP003
Sensitivity: 0.5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



TP004
Sensitivity: 0.5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



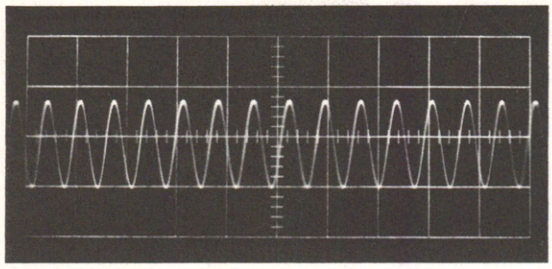
TP005
Sensitivity: 5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



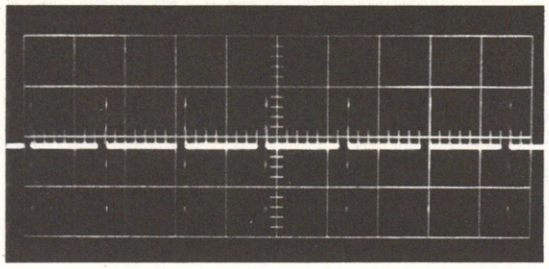
TP006
Sensitivity: 0.5V/Division
Sweep Rate: 5 msec/Division
Trigger: Sync

V06723

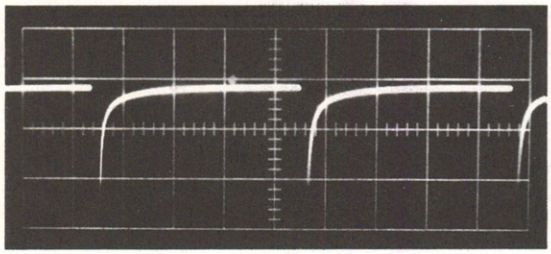
Figure 8-31. Amtec Accessory Waveform



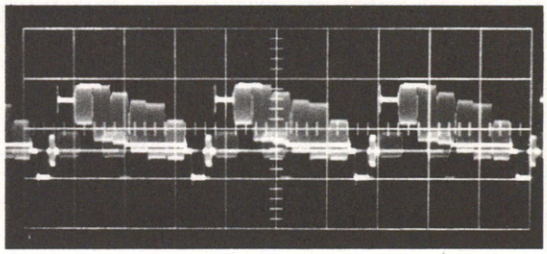
TP001
Sensitivity: 0.5V/Division
Sweep Rate: 0.4 μsec/Division
Trigger: Internal



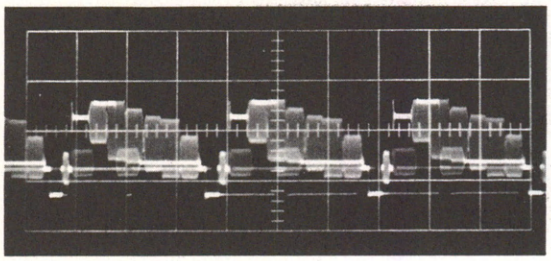
TP002
Sensitivity: 2V/Division
Sweep Rate: 40 μsec/Division
Trigger: Internal



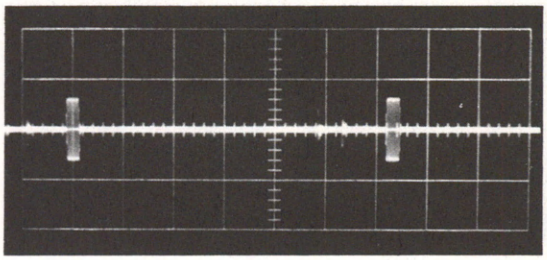
TP003
Sensitivity: 0.2V/Division
Sweep Rate: 4 msec/Division
Trigger: Internal



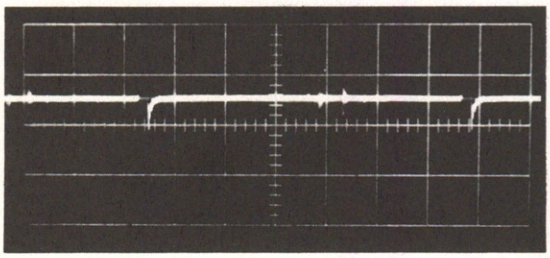
TP004
Sensitivity: 0.5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



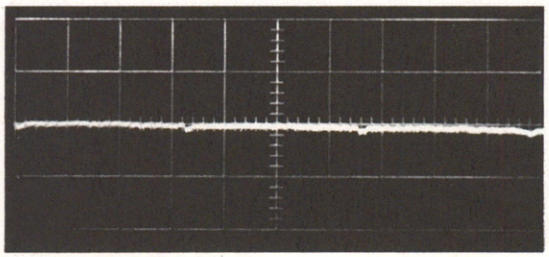
TP005
Sensitivity: 0.5V/Division
Sweep Rate: 20 μsec/Division
Trigger: Sync



TP006
Sensitivity: 0.2V/Division
Sweep Rate: 10 μsec/Division
Trigger: Sync



TP007
Sensitivity: 0.2V/Division
Sweep Rate: 10 μsec/Division
Trigger: Sync



TP008
Sensitivity: 0.5V/Division
Sweep Rate: 5 msec/Division
Trigger: Sync

V06724

Figure 8-32. Colortec Accessory Waveforms

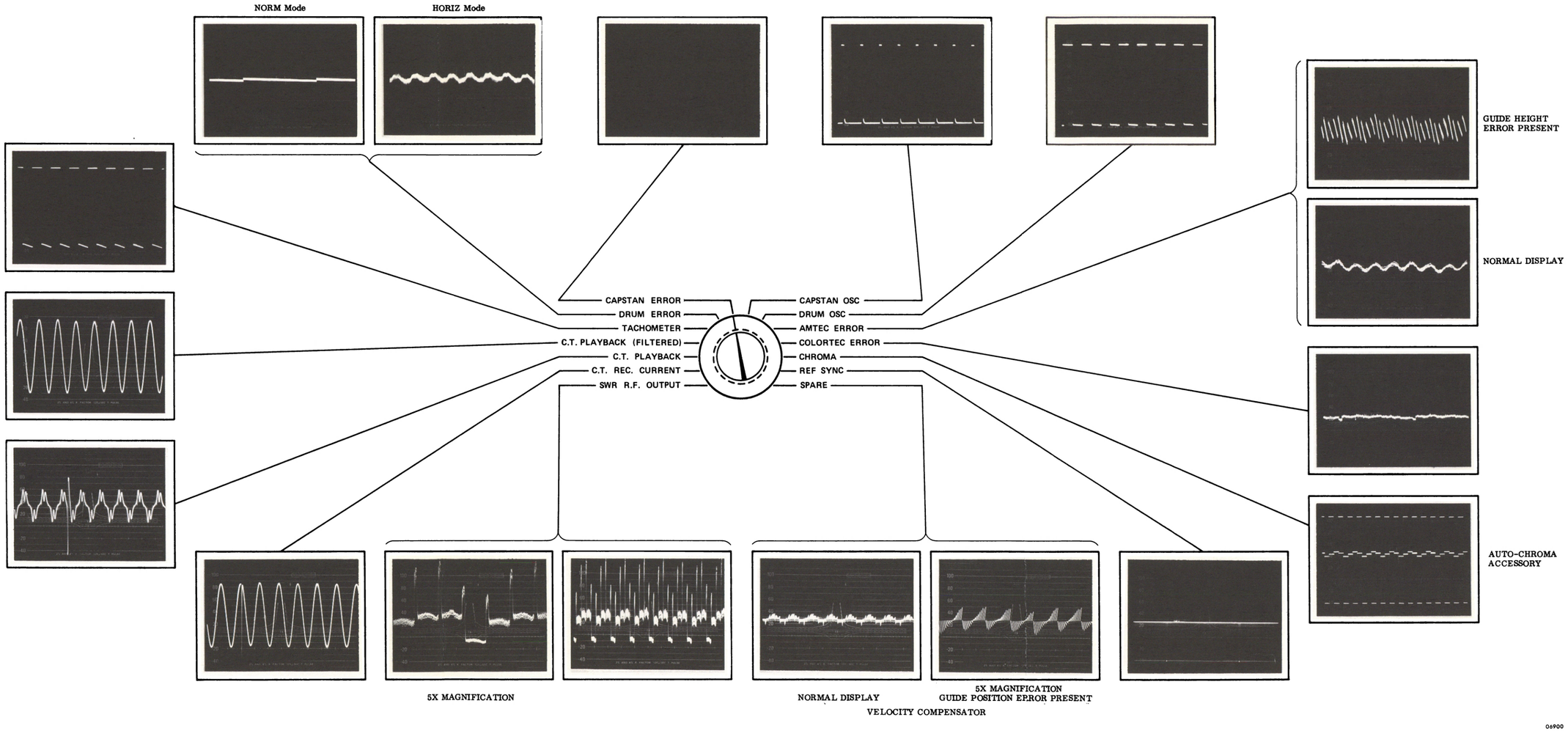


Figure 8-33. Typical Waveform Monitor Displays

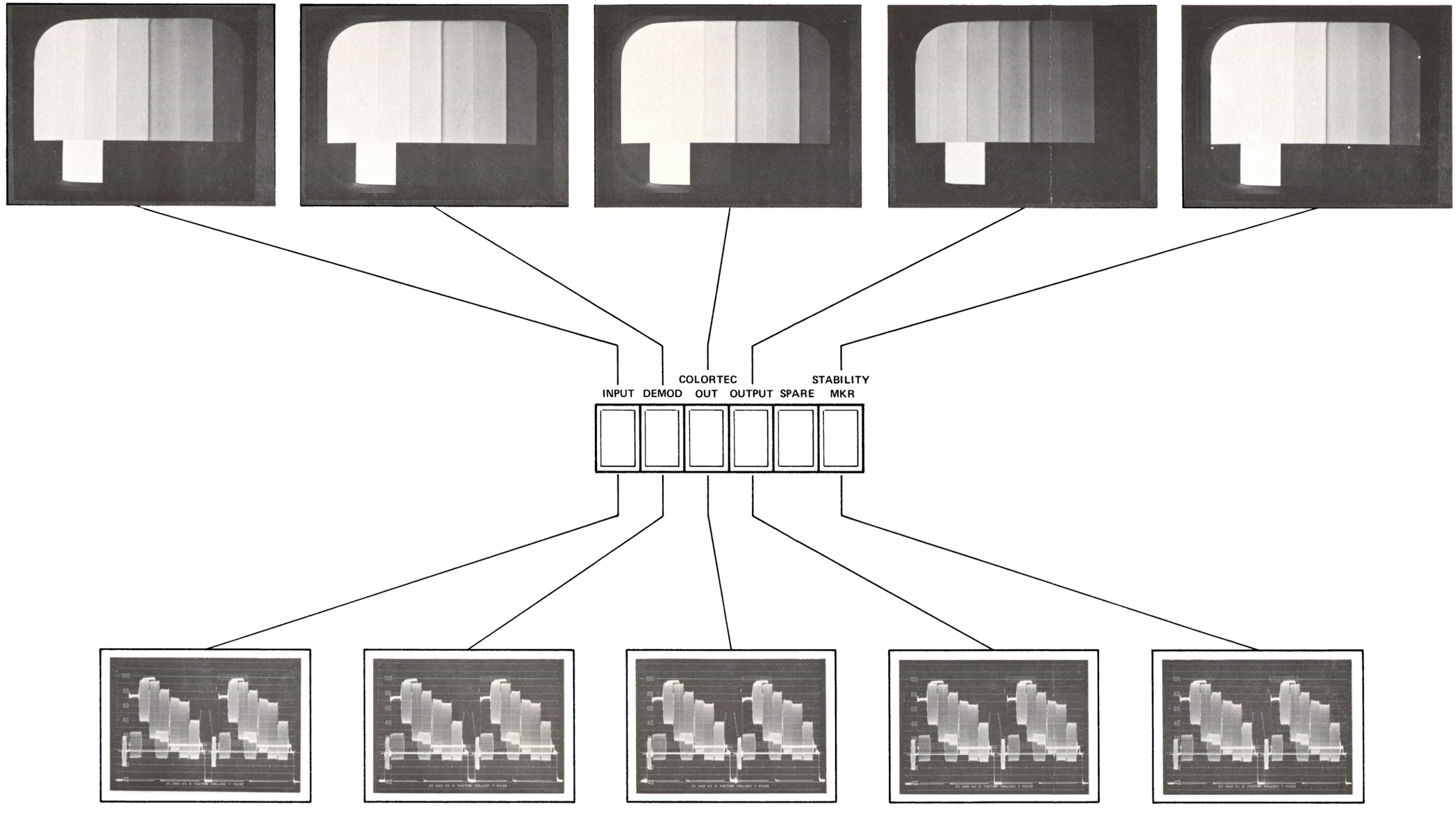


Figure 8-34. Typical Video Monitor Displays

APPENDIX A

APPENDIX

The Appendix contains maintenance check-lists which the user may wish to employ to ensure that the routine maintenance procedures delineated in Chapter 5 have been performed. In addition, the 25-hour check-list includes a data log. Information from this log regarding the RECORD CURRENT meter reading at the last setting of optimum record current may be referred to if the controls have been accidentally moved. This will eliminate the need to perform the entire procedure between 25-hour periods.

The use of a 15-year period in these tables is purely arbitrary, and should not be construed to mean that the useful life of the VR-1200 is limited to this period, or that Ampex Corporation warrants that the video recorder will perform satisfactorily for this period.

RECORDER SERIAL NUMBER _____ OWNER _____

DAILY MAINTENANCE CHECK-LIST

YEAR	MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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PERFORMED ☑ NOT PERFORMED OR RECORDER NOT IN USE ⊘ NO SUCH DATE IN THIS MONTH ☒

AMPEX

RECORDER SERIAL NUMBER _____ OWNER _____

DAILY MAINTENANCE CHECK-LIST

YEAR	MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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RECORDER SERIAL NUMBER _____ OWNER _____

DAILY MAINTENANCE CHECK-LIST

YEAR	MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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AMPEX

RECORDER SERIAL NUMBER _____ OWNER _____

DAILY MAINTENANCE CHECK-LIST

YEAR	MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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AMPEX

RECORDER SERIAL NUMBER _____ OWNER _____

DAILY MAINTENANCE CHECK-LIST

YEAR	MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
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AMPEX

RECORDER SERIAL NUMBER _____ OWNER _____

DAILY MAINTENANCE CHECK-LIST

YEAR	MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
19____	JAN																															
	FEB																															
	MAR																															
	APR																															
	MAY																															
	JUN																															
	JUL																															
	AUG																															
	SEP																															
	OCT																															
	NOV																															
	DEC																															
19____	JAN																															
	FEB																															
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	JUL																															
	AUG																															
	SEP																															
	OCT																															
	NOV																															
	DEC																															

PERFORMED ☑ NOT PERFORMED OR RECORDER NOT IN USE ☒ NO SUCH DATE IN THIS MONTH ☒

AMPEX

RECORDER SERIAL NUMBER _____ OWNER _____

25-HOUR MAINTENANCE CHECK-LIST AND DATA LOG

DATE	INITIALS	HEAD HOURS	HEAD SERIAL	TIP PROJECTION				RECORD CURRENT				PLAYBACK EQUALIZATION					CONTROL TRACK RECORD CURRENT LEVEL
				1	2	3	4	1	2	3	4	MASTER	1	2	3	4	

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AMPEX